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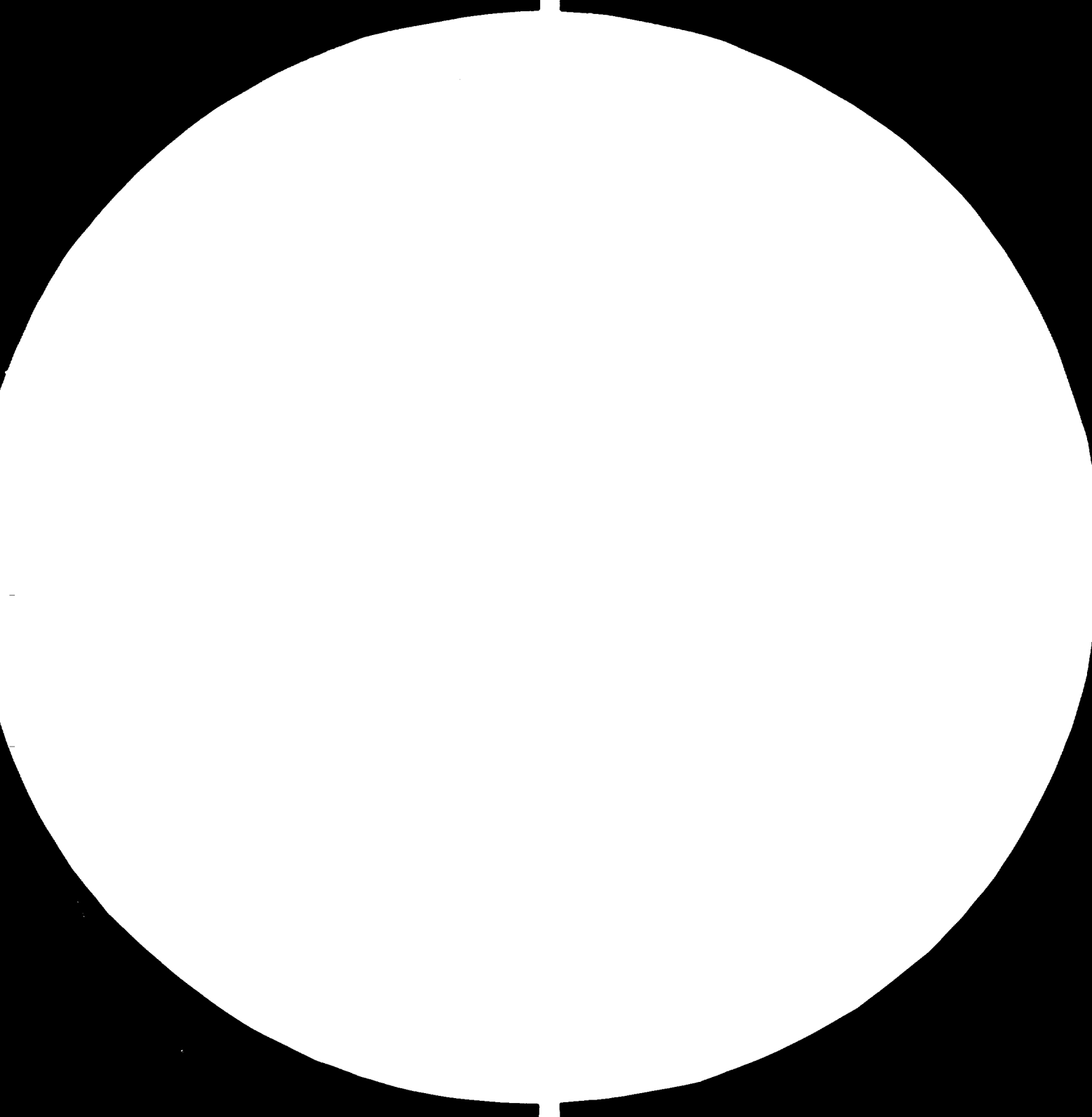
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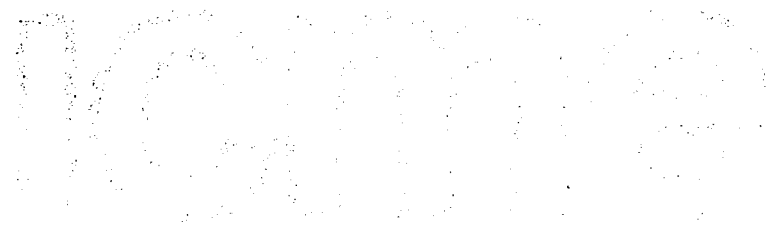
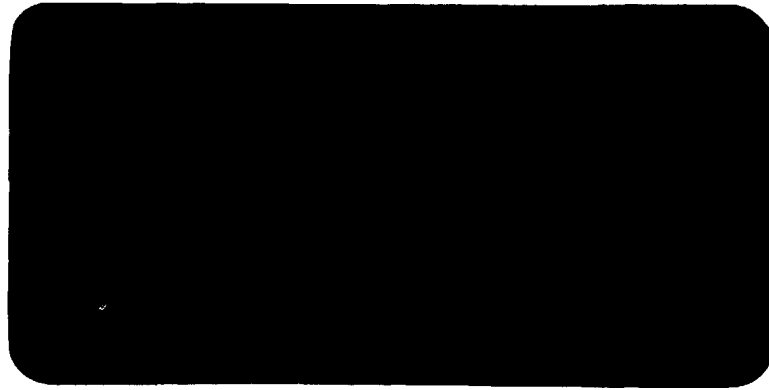
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UNIDO Contract No. 81/19  
Project No. DP/KEN/74/007

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DEVELOPMENT OF ELECTRONICS  
INDUSTRY IN KENYA

FINAL REPORT

to

United Nations Industrial  
Development Organization (UNIDO), Vienna

by

ICME Business Consultants  
Bellariastrasse 51  
CH-8038 Zurich

October 1981

# ICme

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## TABLE OF CONTENTS

---

| S U M M A R Y |  | A - H |
|---------------|--|-------|
|               |  | Page  |
| 1.            | INTRODUCTION   |       |
| 1.1           | BACKGROUND AND INITIATIVES TAKEN BY THE GOVERNMENT OF KENYA                                | 1     |
| 1.2           | THE UNIDO-SPONSORED STUDY  | 2     |
| 2.            | METHOD EMPLOYED IN CARRYING OUT THE STUDY  | 3     |
| 3.            | BRIEF HISTORY AND PRESENT STRUCTURE OF THE ELECTRONICS INDUSTRY IN KENYA                   | 4     |
| 3.1           | SALES AND SERVICE ORGANISATIONS  | 4     |
| 3.2           | ASSEMBLY   | 4     |
| 3.3           | MANUFACTURING AND LOCAL CONTENT  | 5     |
| 3.4           | LOCALLY-DEVELOPED PRODUCTS   | 5     |
| 3.5           | MANPOWER AND TRAINING  | 6     |
| 4.            | ECONOMIC AND POLITICAL CONSTRAINTS TO THE DEVELOPMENT OF THE ELECTRONICS INDUSTRY IN KENYA | 11    |
| 4.1           | GENERAL ECONOMIC SITUATION   | 11    |
| 4.2           | FOREIGN EXCHANGE POLICIES  | 12    |
| 4.3           | PROTECTION AND REGULATION OF THE ELECTRONICS INDUSTRY                                      | 12    |
| 5.            | EXISTING MARKET FOR ELECTRONIC PRODUCTS IN KENYA   | 15    |
| 5.1           | MARKET SEGMENTS AND SIZE   | 15    |
| 5.2           | MAJOR PUBLIC SECTOR PURCHASES AND USERS  | 18    |
| 5.3           | MAJOR PRIVATE SECTOR PURCHASERS AND USERS  | 18    |
| 5.4           | INDIVIDUAL PURCHASERS OF DOMESTIC ELECTRONIC PRODUCTS                                      | 18    |

# ICME

| <u>TABLE OF CONTENTS (continued)</u>   |   | Page |
|--|---|------|
| 6.   | FUTURE MARKET FOR ELECTRONIC PRODUCTS IN KENYA  | 20   |
| 6.1  | DOMESTIC ELECTRONICS  | 21   |
| 6.2  | COMMUNICATIONS ELECTRONICS  | 21   |
| 6.3  | INDUSTRIAL INSTRUMENTATION AND DIGITAL ELECTRONICS  | 22   |
| 7.   | SHORT-TERM STRATEGY FOR KENYA: MANUFACTURE OF CERTAIN ELECTRONIC- AND NON-ELECTRONIC COMPONENTS TO INCREASE LOCAL CONTENT | 23   |
| 7.1  | ECONOMIC JUSTIFICATION OF THE STRATEGY  | 27   |
| 7.2  | TECHNICAL JUSTIFICATION OF THE STRATEGY   | 29   |
| 7.3  | ROLE OF THE PROPOSED KENYA ELECTRONIC DEVELOPMENT CENTRE (KEDEC)  | 30   |
| 8.   | PROPOSED ACTIONS FOR ENCOURAGING THE DEVELOPMENT OF THE ELECTRONICS INDUSTRY IN KENYA                                     | 32   |
| 8.1  | MODIFY CERTAIN POLICIES   | 34   |
| 8.2  | PERFORM DETAILED FEASIBILITY STUDIES: LOCAL MANUFACTURE OF SELECTED COMPONENTS; KEDEC                                     | 36   |
| 8.3  | FORM A SMALL ENTREPRENEURIAL TEAM TO ORGANISE THE MANUFACTURE OF SELECTED COMPONENTS                                      | 37   |
| 8.4  | IMPLEMENT THE FIRST STAGE OF THE PROPOSED KENYA ELECTRONIC DEVELOPMENT CENTRE (KEDEC)                                     | 38   |
| 8.5  | INITIATE SECOND STAGE OF KEDEC  | 51   |
| 8.6  | PREPARE AND IMPLEMENT THIRD STAGE OF KEDEC  | 54   |
| 9.   | TRAINING REQUIREMENTS AND SOURCES OF TECHNICAL KNOW-HOW APPROPRIATE FOR CARRYING OUT THE PROPOSED ACTIONS                 | 57   |
| APPENDIX A: LETTER SENT BY ICME TO SEVERAL PRESIDENTS OF EUROPEAN AND AMERICAN ELECTRONICS COMPANIES BEFORE DEPARTURE OF PROJECT TEAM TO KENYA |   |      |

# ICme

---

## TABLE OF CONTENTS (continued)

- APPENDIX B: PART 1: ELECTRONIC PRODUCT MANUFACTURERS  
SALES AND SERVICE ORGANISATIONS/RESEARCH  
CENTRES LOCATED OUTSIDE OF KENYA AND IN-  
INTERVIEWED DURING COURSE OF STUDY
- PART 2: ELECTRONIC PRODUCT MANUFACTURERS  
LOCATED OUTSIDE OF KENYA, CONTACTED, BUT  
NOT INTERVIEWED IN-DEPTH
- PART 3: OTHER KENYAN ORGANISATIONS, CON-  
TACTED DURING COURSE OF STUDY, BUT NOT  
INTERVIEWED IN-DEPTH
- APPENDIX C: AVERAGE ANNUAL IMPORTS (1979-1980) OF  
ELECTRONIC PRODUCTS TO KENYA
- APPENDIX D: FUNCTIONS, ORGANISATIONS, AND FACILITIES  
OF A NATIONAL TELECOMMUNICATIONS TESTING  
AND RESEARCH AND DEVELOPMENT CENTRE:  
EXAMPLE OF THE SWISS PTT



# ICme

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## LIST OF TABLES

|   | Page |
|---|------|
| TABLE 1: Kenyan electronic product assemblers, sales and service organisations, and manufacturers, contacted and interviewed during the course of the study | 7    |
| TABLE 2: Kenyan electronic product assemblers, sales and service organisations, and manufacturers, contacted but not interviewed in-depth                   | 10   |
| TABLE 3: Monthly salary range by industrial employee type in Kenya  | 13   |
| TABLE 4: Market share (1979-1980) of exporting countries for electronic products imported by Kenya  | 17   |
| TABLE 5: Major Kenyan public-sector purchasers and users of electronic products   | 19   |
| TABLE 6: Non-electronic components which could be manufactured in Kenya   | 24   |
| TABLE 7: Electronic circuitry components which could be manufactured in Kenya   | 25   |
| TABLE 8: Classification of components of an electronic device into "electronic" and "non-electronic"; Example: Electronic Hygrometer                        | 26   |
| TABLE 9: Definition and flowsheet of tasks for the start-up of KEDEC and for adding product lines requiring no development work                             | 40   |
| TABLE 10: Definition of the stages of KEDEC and implementation timing   | 42   |
| TABLE 11: Definitions of tasks of the Commercial-, Technical-, and Control, Testing and Development Departments   | 46   |

# ICME

---

| <u>LIST OF TABLES (continued)</u> |  | Page            |
|-----------------------------------|--|-----------------|
| TABLE 12:                         | KEDEC staff number and qualifications;<br>end of first stage of KEDEC  | 50              |
| TABLE 13:                         | Additional staff needed to implement<br>KEDEC second stage; total staff for<br>second stage  | 52              |
| TABLE 14:                         | Flowsheet of activities required for the<br>development of an electronic device; re-<br>sponsibilities of KEDEC, contractors, and<br>end-users of device | 53              |
| TABLE 15:                         | Staff, volume of activities and cost struc-<br>ture of the Swiss PTT Telecommunications,<br>Testing, Research and Development Centre                     | Appendix D<br>2 |
| TABLE 16:                         | Technical characteristics of the Swiss<br>PTT Telecommunications, Testing, Research<br>and Development Centre building                                   | Appendix D<br>3 |

## LIST OF FIGURES

|   | Page            |
|---|-----------------|
| FIGURE 1: Role of KEDEC first and second stages, in components manufacture                                      | 39              |
| FIGURE 2: Work load (man-hour) distribution of the Kenya Electronic Development Centre (first and second stage) | 44              |
| FIGURE 3: Organisation chart, KEDEC first and second stages   | 45              |
| FIGURE 4: KEDEC third stage work load (man-hour) distribution   | 55              |
| FIGURE 5: Organisation chart, KEDEC stage three   | 56              |
| FIGURE 6: Organisation chart of Swiss PTT Telecommunications, Testing, Research and Development Centre          | Appendix D<br>1 |
| FIGURE 7: Vertical building plan Swiss PTT Telecommunications, Testing, Research and Development Centre         | Appendix D<br>4 |
| FIGURE 8: Typical floor scheme, Swiss PTT Telecommunications, Testing, Research and Development Centre          | Appendix D<br>5 |

## S U M M A R Y

### 1. THE PRESENT ELECTRONICS INDUSTRY IN KENYA AND EXISTING MARKET

An electronics industry exists in Kenya, but it is quite young. Sales and service organisations have been present for about 20 years, and assembly of some consumer electronics products began in about 1974.

The industry has the following structure:

- Sales (wholesale) and service organisations --

Most of the electronics firms in Kenya fall into this category

- Assemblers --

There are about six assemblers of electronics products in Kenya. All but one (assembler of telephone handsets) are in consumer electronics. The electronic products assembled in Kenya are mostly radios and radio-cassettes.

- Manufacturing --

Some simple manufacturing for the electronics industry exists:

- . moulding of plastic cases for telephone handsets
- . manufacture of some radio and T.V. cabinets, including modern laminating facilities
- . manufacture of some wire and solder
- . some, very limited, packaging materials

The value of imports of electronic equipment by Kenya is about US \$ 55,000,000 annually. Imports are mainly from Europe (70 %), Japan (15 %), and North America (5 %). Approximate sizes of the segments of the market are:

- |  |                       |
|--|-----------------------|
| - Domestic electronics:                                | US \$ 17,500,000/year |
| - Communications electronics:                          | US \$ 23,250,000/year |
| - Industrial, instrumentation and digital electronics: | US \$ 14,250,000/year |

## 2. FUTURE MARKET FOR ELECTRONICS PRODUCTS IN KENYA AND POTENTIAL FOR EXPORT FROM KENYA

The market potentials are forecasted in qualitative terms only, because quantitative projections would be meaningless for two reasons:

- the values of imports as cited above are only indicators of the size of the market segments and cannot be projected or extrapolated with any meaning
- no meaningful quantitative projections for economic growth parameters are available for Kenya. On the whole, markets for electronic products in Kenya will grow at slow or moderate rates

A major problem which will affect future purchases of consumer electronics is inflation. Price reductions coinciding with expanding markets and more efficient production cannot be counted upon.

The communications electronics market is more transparent and is largely based on identifiable official programmes.

Digital electronics is presently a small market but appears to be growing fairly rapidly as businesses and other organisations modernise. This segment should experience continued moderate growth.

The industrial electronics market is currently very small and will hardly grow within the next ten years.

The instrumentation electronics segment should grow steadily, with the highest growth in telecommunications instrumentation and general test and measuring instruments.

The export potential of electronic products which could be manufactured or assembled in Kenya is negligible, and the same is true for electronic and non-electronic components which could be manufactured in Kenya. Therefore, the "feasibility" of any manufacturing operation for electronics products, electronic components, or non-electronic components must be based on the Kenyan market exclusively as the target market.

### 3. ECONOMIC MANUFACTURE OF ELECTRONIC AND NON-ELECTRONIC PRODUCTS IN KENYA

After careful analysis of the existing electronics industry in Kenya and of trends in world-wide electronics manufacturing and marketing, the authors conclude that the industry in Kenya should aim at increasing the local content of locally-assembled products.

To this end, various electronic and non-electronic components have been pre-selected (Tables 7 and 8). Further analysis is needed to determine exactly which components should be manufactured. However, the authors think that some mix of the pre-selected components is probably feasible for manufacture.

Manufacture of a mix of components from Tables 7 and 8 could result in an increase in local content of up to 30 %.

Two essential inputs are necessary for the undertaking of the manufacture of such components in Kenya:

- A feasibility study (to determine exactly which components to manufacture, what equipment is necessary, etc.)
- An arrangement to provide the testing and control facilities and skilled personnel required

The undertaking of the feasibility study is suggested to be the responsibility of the IPD of the Kenyan Ministry of Industries. It is in the interest of the government and the electronics industry to proceed quickly.

The required testing and control facilities and skilled personnel are to be part of a proposed government-sponsored auto-financed facility called in this report the Kenyan Electronics Development Centre (KEDEC).

#### 4. TRAINING AND DEVELOPMENT OF LOCAL SKILLS

Training required for the proposed actions of this report is closely linked to the several phases of KEDEC. Initially, training is required for the personnel at KEDEC involved in the control and testing of electronic and non-electronic components manufactured with the technical assistance of KEDEC. Sources of such training are:

- Certain of the electronic companies already established in Kenya
- The "Polytechnic"
- Kenyan Institute of Management
- Sources outside of Kenya, such as experts in control and testing supplied through UNIDO

This training would have to be expanded should KEDEC take on two other functions: control and testing, and quality assurance of electronics products assembled in Kenya. The same sources of training know-how apply.

The largest training component will be required for the replacement of expensive foreign skills with new Kenyan skills in the troubleshooting, testing, and repair of expensive, complex telecommunications equipment. The most appropriate arrangement for training for this task, scheduled for the third stage of KEDEC, is likely to be by contracting with an established telecommunications, research and development centre of a second country.

## 5. SERVICES TO BE PROVIDED BY KEDEC

As mentioned above, KEDEC would be charged with control and testing and quality assurance of electronics products manufactured or assembled in Kenya.

These services require some expensive and complex equipment as well as skilled personnel. By centralizing such equipment and personnel, the following benefits are imparted to the young Kenyan electronics industry:

- The obstacles of a major capital investment (testing and control equipment) and of major costs (skilled personnel) are removed from the path of new electronics products assembly or manufacture in Kenya.
- The quality and scope of control and testing available to the industry is improved.

Resulting from KEDEC's services:

- Standards are established to be used in the manufacture of components in Kenya
- Uniformity of, and a reference for, the control and testing functions are established
- The credibility of the industry, the saleability of its products, and its ability to attract new investments are all enhanced

Another major service of KEDEC will be the troubleshooting, testing and repair of expensive, complex telecommunications equipment presently done by foreign skills.

KEDEC would not merely be in the business of providing valuable services (on a service-fee basis). The organisation would also play a key role in steering the course of the electronics industry in Kenya. From the start, KEDEC will be involved in coordinating the manufacture of components with private industry partners. Later, KEDEC will be involved in the coordination of the development of the industry, notably through:

- Policy recommendations to government agencies
- Coordination with the Kenyan Bureau of Standards, government agencies, private companies in the industry, and final users of electronics products



At this time, it is not possible to give details on the equipment required by KEDEC in its various stages. This can only be done after the exact components to be manufactured are known and when the exact services to be provided in the testing and control of assembled and manufactured final products are finalized. Likewise, it is premature to describe the equipment needed for KEDEC's role in troubleshooting, testing, and repair of complex telecommunications equipment.

#### 6. SOURCES OF KNOW-HOW

Sources of training; know-how have already been described above. For equipment for components manufacture priority should be given to companies from countries which have the "highest stake" in the Kenyan electronics industry, based on investment in Kenya and value of imports. In this way, the components manufactured can most readily be incorporated into the electronic products already manufactured in Kenya and the possibilities of attracting new electronics investments in Kenya can be maximised. The countries with the highest stakes are, based on import values: England, Japan, Germany, Holland, and France. Based on investments in assembling operations in Kenya, the list is shortened to Holland and Japan.

Sources of equipment for the troubleshooting, testing and repair of telecommunications equipment must be carefully decided after consideration of the long-term development of telecommunications in Kenya. Presently, sources of equipment and the related test, diagnostic, and repair equipment change frequently, contrary, perhaps to the coherence of development of telecommunications.

## 7. CAPITAL COSTS FOR THE MANUFACTURE OF COMPONENTS

It is premature to cite capital costs at this point, because the exact components to be manufactured are not known.

## 8. GOVERNMENT POLICIES FOR PROMOTING THE INDUSTRY

It is precisely changes in policy which are likely to have a greater impact on the electronics industry in Kenya than the other measures proposed: components manufacture and the establishment of KEDEC.

The most important policy changes which need to be made are:

- Formulate appropriate duties for imported electronics products: components, kits, finished products
- Expedite the official processing of applications for the local assembly or manufacture of electronics or electronics-related products
- Eliminate arbitrariness in the granting of import licenses
- Establish clear and precise definitions (to be used by the Kenyan Customs) of all electronic products or electronic-related products
- Guarantee minimum annual equipment purchases by governmental agencies of certain locally-made or locally-assembled electronics products so as to encourage local-assembly or manufacturing projects
- Undertake to promote price competition
- Streamline procedures in dealing with governmental agencies

The following conclusions should be emphasized:

- Policy changes are likely to do more for the development of the Kenyan electronics industry than any other action
- Large-scale employment opportunities are not possible in the Kenyan electronics industry
- Export potential of electronics or electronics-related products from Kenya is negligible for the short term. However, some potential for export to other developing countries only may develop after five years or more. In order to be competitively positioned for exploiting such future potential the Kenyan electronics industry would have to make significant gains in:
  - . production efficiency (and attendant cost reductions)
  - . quality of finished goods
  - . distribution efficiency
  - . price competitiveness
- The local content of electronics products already assembled in Kenya or which could be assembled in Kenya could be increased significantly with the local manufacture of certain electronic and non-electronic components
- The proposed KEDEC organisation is not absolutely essential to the development of the electronics industry in Kenya. It could, however, result in:
  - . increased local content of locally-assembled products through the initiating of components manufacture, and the attendant acquisition of know-how and skills which will later on allow expansion into other types of industrial activities without unduly soliciting the balance of trade
  - . centralised control and testing facilities which could help attract new electronics investments
  - . a vehicle for policy change and policy guidance -- essential elements to the development of the industry
  - . a general upgrading of the industry which would be necessary for future exporting
  - . skills development and cost savings in the area of troubleshooting, testing, and repair of complex, expensive telecommunications equipment (it should be recognized that KEDEC would not be the only eligible candidate organisation to require such skills)

## 1. INTRODUCTION

### 1.1 BACKGROUND AND INITIATIVES TAKEN BY THE GOVERNMENT OF KENYA

On the 15th of April, 1981, the Ministry of Industry through its Industrial Promotion Department (IPD), held a meeting with many of the representatives of the electronics industry in Kenya (government bodies, universities, private industry) with the purpose of communicating its intentions of developing the electronics industry and the actions already taken. The meeting presented an opportunity for the various parties to the industry to express their views on past and current problems and directions for the future.

The Government of Kenya gives high priority to the development of the electronics industry in the current fourth National Development Plan (1978-1983) and has taken many initiatives including the following:

- IDP contacted some international consulting agencies for the preparation of a "Perspective Plan for the Development of the Electronics Industry in Kenya". After considering the offers received, the Government signed an agreement with the "Electronics Technology and Trade Development Corporation (ETTDC)" of New Delhi - an agency of the Government of India - for the preparation of this project report. The Kenyan National Council of Science and Technology has alloted the funds required for it (US\$15,000). The ETTDC team was expected to begin the preparation of their report in May 1981.
- IPD also approached UNIDO for necessary technical and financial assistance for an independent project report concerning all aspects of the development of the electronics industry in Kenya. UNIDO awarded this assignment to the authors of this report.
- The Government recommended to UNIDO the inclusion of the establishment of an Electronics Development Centre in the UNIDO Country Programme (1982-1985) for Kenya, which was endorsed by the UNIDO Country Mission in December 1980. If finally approved, it is likely to be established at a cost of US\$ 1.6 million within the next 4-5 years.

- The Government of India signed an agreement with the Government of Kenya and has agreed to offer technical assistance in the form of training facilities and the establishment of an Electronics Research and Development Centre.
- Various kinds of training courses are foreseen for local engineers and technicians to improve existing service and maintenance. Kenya badly lacks servicing and maintenance facilities for costly electronic equipment imported directly by parastatal bodies and governmental institutions. Such facilities are needed because the cost of expertise to diagnose faults and replace defective components is comparatively much higher than the cost of the imported spares.

## 1.2 THE UNIDO-SPONSORED STUDY

As part of its programme to stimulate industrial development and prosperity in Kenya, the Government of Kenya, through its Ministry of Industries, undertook the task of closely studying the existing electronics industry in Kenya in order to more appropriately formulate policies and programmes aimed simultaneously at regulating and encouraging the growth of that industry.

The industrial advisers to the Ministry of Industry, the United Nations Industrial Development Organisation (UNIDO), selected the authors of this report to assist the Ministry in the study of the electronics industry in Kenya. Essentially, the objectives of this study were to:

- Investigate the current state of the electronics industry in Kenya
- Determine which branches of electronics could be started, developed, or encouraged most appropriately in Kenya
- Recommend policies and programmes to start, develop, or encourage the selected industry branches and to more appropriately regulate and encourage the industry in general.

## 2. METHOD EMPLOYED IN CARRYING OUT THE STUDY

Two ICME senior consultants first spent one man-month each in the project area - mainly Nairobi, Kenya - and then one man-month each in Europe interviewing European and American electronics companies.

The letter sent to the company presidents is presented as Appendix A of this report.

Work in the project area followed the programme:

- Familiarisation of the project team with prior relevant work done by the Ministry of Industry
- Formulation of detailed work plan integrating tasks for the two ICME consultants with those for the two Ministry project engineers
- Interviewing of representatives of the electronics industry in Kenya:
  - . Assemblers
  - . Sales and service organisations
  - . Manufacturers
  - . Major public-sector customers
  - . Retail stores
- Gathering economic and demographic information with emphasis on data on imports of electronic components and products and tariffs and duties
- Interviewing governmental- and industry organisations concerned with the development of the electronics industry in Kenya.

In the second stage of the project, the ICME team interviewed executives of several European and American electronics firms to explain the findings of the first stage and, subsequently, to determine the willingness of the companies to participate in the development of the electronics industry in Kenya and the conditions required for such participation. The firms contacted are presented in Appendix B.

## 3. BRIEF HISTORY OF THE ELECTRONICS INDUSTRY IN KENYA

### 3.1 SALES AND SERVICE

Perhaps the oldest electronics firms in Kenya are those involved in the sales and service of telecommunications equipment. At least one such firm has maintained an office in Nairobi for the past 20 years. More recently, other foreign firms in domestic electronics and instrumentation electronics have established offices in Kenya. Testing, calibration, and repair services for such equipment as aviation electronics have been available for about 15 years.

### 3.2 ASSEMBLY

Since about 1974, two locally-owned companies have been assembling radios in Nairobi. Starting with simple knocked-down kits (SKD kits) for pocket- and portable transistor radios, they gradually added facilities and provided training for the assembly from completely knocked-down kits (CKD kits). With the growing international popularity of radio-cassette portables, these were added to the mix of locally-assembled products by the two firms in about 1978.

At about the same time as the start of assembly by the two locally-owned companies, a major Japanese company began assembly of similar products.

A few years later, after the closing of the Kenyan border with Tanzania, a major European electronics company transferred, on a small scale, some of its assembly of radios and radio-cassettes to Nairobi from Tanzania and subsequently undertook the manufacture and recording of phonograph records and the recording of stereo cassette tapes. This company is supplied with blank cassette tapes by a local company which assembles the tape-cassettes.

The assembly of black-and-white TV sets was initiated in about 1979 by the major Japanese company and by one of the local companies. Since then, both companies have added colour TV assembly, the Japanese company installing vastly more modern facilities

than the local company. Television technology was transferred to the local company through an arrangement with a major European components and know-how marketing group which allows the local company great flexibility in minimum order quantities.

In the field of telecommunications, one locally-owned company assembles telephone handsets under an agreement with a major European manufacturer. This local company is now the official supplier for the Kenyan Post and Telecommunications, and before official approval of any proposed importation of handsets, this company must first attest that it is not capable of producing the proposed handsets.

### 3.3 MANUFACTURING AND LOCAL CONTENT

The most significant manufacturing of electronics related products in Kenya are:

- moulding of telephone handset cases and receivers (by the local assembler mentioned above in 3.2)
- laminating of TV and radio cabinets with artificial wood veneer using modern equipment
- manufacture of the cabinets to be laminated in above operation.

In addition, some locally-made solder and wire is used in the assembly of CKD kits. The local manufacture of packaging material is increasing, but the equipment does not exist locally to print cartons of the eye-catching quality that retail customers immediately identify with brand-name quality electronics products. More locally-made packing materials are being used, but lacking is the equipment required for moulding poly-styrene foam, the typical packing material.

Local manufacture of electronic components does not exist in Kenya. Some electronic products, portable radios and radio-cassettes, are manufactured in Kenya, to the extent that CKD kit assembling can be considered manufacturing.

### 3.4 LOCALLY-DEVELOPED PRODUCTS

The two local assemblers first to start operations in Kenya have developed, respectively, a line of gram-



phones and a line of radio-phonograph consoles (mono and stereo) using SKD or finished record changers and SKD or CKD amplifiers and radios. It is not known how much success these products have had on the local market, but it is apparent from the factory visits of the project team that the business priorities of the developers are with other products.

There is apparently a non-negligible reserve of electronics product development talent in Kenya, much or all of which goes untapped mainly because of lack of components in prototype quantities.

Tables 1 and 2 present a summary of the existing organisations in the electronics industry in Kenya.

### 3.5 MANPOWER AND TRAINING

There appears to be no shortage of qualified people for entry-level positions in industry. All persons interviewed were satisfied with the technical education of their new employees.

Some employers indicated a preference for job candidates having technical training gained in the military.

On-the-job training in industry is supplemented with formal training by trainers sent to Kenya by the parent- or technology-supplying company (European or Japanese).

Training in after-sales-service is done in three ways:

- training in Kenya by parent- or technology-supplying company
- training at headquarters of parent- or technology-supplying company (in Europe or Japan)
- training in Kenya through service courses offered under contract by the Kenyan Institute of Management.

Continuing technical education for promising employees is effected through a company's sponsorship of those employees in courses and degree programmes of the Kenya Polytechnic. Graduates of the Polytechnic typi-

TABLE 1: Kenyan electronic product assemblers, sales and service organisations, and manufacturers, contacted and interviewed during the course of the study

| <u>BRANCH OF ELECTRONICS INDUSTRY<br/>PERSONS CONTACTED/ORGANISATIONS</u>     | <u>ACTIVITY</u>  |
|---|--|
| <u>DOMESTIC ELECTRONICS</u>   |  |
| Mr. Shamsudin Kara<br>Managing Director<br>Musicraft Kenya Ltd.               | <ul style="list-style-type: none"> <li>- Assembling of portable radios, radio-cassettes (SKD and CKD kits)</li> <li>- Assembling of own gramophone</li> </ul>  |
| Mr. K. Martin Malinda<br>Deputy Technical Sales Manager<br>JK Industries Ltd. | <ul style="list-style-type: none"> <li>- Assembling of blank cassettes</li> <li>- Recording of stereo cassettes</li> </ul>   |
| Mr. S.T.R. Krishnan<br>Technical Director<br>Allied Electronics Ltd.          | <ul style="list-style-type: none"> <li>- Assembling of portable radios, radio-cassettes (SKD and CKD kits), radio-cassette stereos (SKD kits)</li> <li>- Assembling of TV sets including colour sets (20", 26" screen) (SKD and CKD kits)</li> <li>- Manufacture of TV cabinets (modern laminating machine)</li> </ul> |
| Mr. Kombo<br>Managing Director<br>Business Machines Kenya Ltd.                | <ul style="list-style-type: none"> <li>- Sales of small electronic personal- and business machines such as hand held calculators</li> </ul>  |
| Mr. J. Vieweger<br>General Manager<br>Phillips Electric Lamps (E.A.) Ltd.     | <ul style="list-style-type: none"> <li>- Assembling of portable radios, radio-cassettes (CKD kits), radio-cassette stereos (CKD kits, January 1982)</li> <li>- Recording of stereo cassettes, mono- and stereo records</li> </ul>  |

Note: SKD kit: Simple Knocked-Down kit  
 CKD kit: Completely Knocked-Down kit

TABLE 1: (continued): Kenyan electronic product assemblers, sales and service organisations, and manufacturers, contacted and interviewed during the course of the study

| <u>BRANCH OF ELECTRONICS INDUSTRY<br/>PERSONS CONTACTED/ORGANISATIONS</u>                     | <u>ACTIVITY</u>   |
|---|---|
| <u>COMMUNICATIONS ELECTRONICS</u>   |   |
| Mr. Edoardo Rossi<br>Managing Director<br>Eastern Telecommunications Ltd.                     | <ul style="list-style-type: none"> <li>- Sales of telephone handsets</li> <li>- Sales, installation, service of telephone exchanges, PBX and PABX systems</li> </ul>  |
| Mr. K. Martin Malinda<br>Deputy Technical Sales Manager<br>JK Industries Ltd.                 | <ul style="list-style-type: none"> <li>- Manufacture (moulding) of cases for telephone handsets</li> <li>- Assembling of telephone handsets from kits (official Kenyan supplier to PTT; all orders for imported handsets must be "cleared" by this company).</li> </ul> |
| Mr. E. Nikolasch<br>Chief Inspector<br>Avionics Division<br>International Aeradio (E.A.) Ltd. | <ul style="list-style-type: none"> <li>- Calibration, testing, service and repair of aviation electronics equipment and radio-communications equipment</li> </ul>   |
| Mr. W.R. Peacock<br>Technical Consultant<br>Plessey (East and Central Africa) Ltd.            | <ul style="list-style-type: none"> <li>- Sales of telephone handsets</li> <li>- Sales, installation, service of telephone exchanges, PBX and PABX systems</li> </ul>  |
| Coast Cables Ltd., Mobasa   | <ul style="list-style-type: none"> <li>- Manufacture of telephone-line cables, other wire and cable but not including enameled wire</li> </ul>  |

TABLE 1: (continued): Kenyan electronic product assemblers, sales and service organisations, and manufacturers, contacted and interviewed during the course of the study

| <u>BRANCH OF ELECTRONICS INDUSTRY</u><br><u>PERSONS CONTACTED/ORGANISATIONS</u>                      | <u>ACTIVITY</u>  |
|--|--|
| <u>INSTRUMENTATION ELECTRONICS</u>   |  |
| Mr. Roger Mateer<br>Head of Technical Department<br>Engineering & Sales Co. Ltd.<br>(Rohde & Swartz) | - Sales/service/repair of calibration<br>and testing equipment<br>- Contract calibration service |

TABLE 2: Kenyan electronic product assemblers, sales and service organisations, and manufacturers, contacted but not interviewed in-depth

| <u>BRANCH OF ELECTRONICS INDUSTRY<br/>PERSONS CONTACTED/ORGANISATIONS</u> | <u>ACTIVITY</u>  |
|---|--|
| <u>DOMESTIC ELECTRONICS</u>   |  |
| Sanyo Kenya Ltd.<br>(Interview refused)                                   | - Assembly of radios, radio-cassettes, radio-cassette stereos (SKD or CKD not known)<br><br>- Assembly of television sets including colour sets (SKD or CKD not known) |
| Kenya Electronics Ltd.  | Importer of spare electronic component parts; works under an "agency agreement" with the R.S. Group (Radio Spares) England   |
| United Import Agency Ltd.   | Importer of spare electronic component parts including sophisticated items such as micro-processors  |
| <u>COMMUNICATIONS ELECTRONICS</u>   |  |
| Racal Kenya Ltd.  | Sales/service of specialty telecommunications devices (message encoders, decoders, etc.)   |
| <u>INSTRUMENTATION ELECTRONICS</u>  |  |
| Racal Kenya Ltd.  | Sales/service of electronic instruments  |
| Pegrum's  | Contract calibration service/repair for electronic test instruments  |

cally spend 6 months on the job before being qualified by their employers as inspectors in assembling operations (finding faults, tracing faults back to the sources). The employers consider the 6 month period as entirely satisfactory.

Some employees of governmental organisations such as Post and Telecommunications receive training from equipment suppliers with offices in Kenya and from the Kenyan Institute of Management.

#### 4. ECONOMIC AND POLITICAL CONSTRAINTS TO THE DEVELOPMENT OF THE ELECTRONIC INDUSTRY IN KENYA

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##### 4.1 GENERAL ECONOMIC SITUATION

Kenya is one of the most prosperous countries in Africa despite having few natural resources. Personal incomes are high compared to other African countries, but inflation has been severely reducing the purchasing power of disposable income which is in turn kept from rising by personal income tax policies.

As an example of this double effect, the case below shows the 1981 income level in Kenya required to maintain the same purchasing power as in 1976:

| Personal income<br>January 1, 1976                             | Income tax<br>(1976) | Net income<br>(1976)                                    |   |        |
|--|----------------------|---|---|--------|
| (6,000   | -                    | 1,100)  | = | 4,900  |
| Calculated value<br>equivalent personal<br>income Jan. 1, 1981 | Income tax<br>(1981) | Net income (1981)<br>for equivalent<br>purchasing power |   |        |
| (16,000  | -                    | 6,000)  | = | 10,000 |

The value 15,33% was used for inflation in the above calculation of net income (1981) for equivalent pur-

chasing power from the net income of 1976. The resulting value for equivalent personal income, January 1, 1981, indicates an effective required annual increase in income of 21.67% just to maintain a purchasing power equal to that of 1976.

Kenyan incomes are not increasing at anywhere near this rate. The above example demonstrates the plight of the growing "middle class" of the Kenyan urban population.

Table 3 shows typical salary ranges for different types of industrial employees.

With the erosion of purchasing power, consumption patterns are bound to change. Inflation continues to be the biggest problem for consumers, and is also playing havoc with business planning.

For assemblers of electronics products, inflation coupled with inappropriate government policies can mean, according to the assemblers, that it becomes cheaper to import a finished electronic product than to assemble it in Kenya.

#### 4.2 FOREIGN EXCHANGE POLICIES

The chronic shortage of foreign exchange in Kenya has put pressure on the government to plug the outflows of foreign exchange. Sometimes measures adopted to control the outflow severely handicap local assemblers by interrupting or even completely stopping the flow of imported kits by the halting of import licenses.

The near future will bring no easy remedy to the foreign exchange problem, and modifications to government policies will be needed to permit a steady flow of kits to assemblers. At present, several of the firms contacted in Kenya have had to stop production on at least one product line because of the government's freeze on granting certain import licenses.

#### 4.3 PROTECTION AND REGULATION OF THE ELECTRONICS INDUSTRY

Protection of the local electronics industry by the

TABLE 3: Monthly salary range by industrial employee type  
in Kenya

| <u>EMPLOYEE TYPE</u>      | <u>MONTHLY SALARY RANGE (Ksh)<sup>1)</sup></u> |
|---------------------------|--|
| Chief production engineer | 8,000 - 10,000                                 |
| Engineer                  | 6,000 - 8,000                                  |
| Technician                | 2,000 - 3,000                                  |
| Foreman                   | 1,000 - 2,000                                  |
| Skilled worker            | 750 - 1,200                                    |
| Unskilled worker          | 600 minimum                                    |
| Office staff              | 800 - 1,500                                    |

1) Ksh: Kenyan shilling

Exchange rate: 1000 Ksh = 125 US\$



government takes the form of a tariffs structure for the various types of electronics imports as well as the granting of "official supplier" status to certain local firms engaged in assembly.

The tariff structure for November 7, 1980, to the present is given below:

| Electronic product import | Duty paid by importer on C&F price |                        |
|---------------------------|------------------------------------|------------------------|
|                           | As of Nov. 7, 1980                 | After June 17, 1981    |
| Component                 | 40 %                               | 40 or 60 % (not clear) |
| CKD kit                   | 40 %                               | 60 %                   |
| SKD kit                   | 90 %                               | 90 %                   |
| Finished product          | 110 %                              | 110 %                  |

It can be seen immediately that just recently the tariff on CKD kits was increased by 50% (40% to 60%), thus placing a severe financial strain on the existing assemblers. In some cases, this change may cause firms to abandon assembling altogether.

Mentioned in Chapter 3.2 was the protection of the local assembly of telephone handsets. The assembler must certify that he cannot produce a given type or quantity of handsets before those handset can be imported to Kenya. While this arrangement is satisfactory for the assembler, he has no incentive to expand his production, nor to upgrade the quality of his products, nor to lower his prices. In the absence of guaranteed markets for handsets and other telecommunications equipment, there is no reason for increased assembly of such equipment to be undertaken by locally established firms, foreign or Kenyan.

In dealing with government agencies, local assemblers are faced with several chronic problems:

- Policy is not consistent. For example, customs duties change every year and assemblers are given little or no advance notice of the changes.

- Exactly with whom to deal in a particular agency is rarely clear. Much time is consumed by the assembler in dealing with the bureaucracy.
- Customs definitions of "components", "SKD kit" and "CKD kit" are vague, and the classifications actually made are in some cases damaging to the development of electronic products assembling in Kenya.
- Action by the government on proposals for new local assembly projects is often slow, and when approval is denied, the exact reasons are often not clear.
- There do not appear to be any incentives for export of locally assembled or manufactured electronic- or electronics-related products.

## 5. EXISTING MARKET FOR ELECTRONICS PRODUCTS IN KENYA

### 5.1 MARKET SEGMENTS AND SIZE

The three main market segments and their respective average annual import values and percent of total electronics/electronics-related imports are given below.

- Domestic electronics - pocket and portable radios, radio-cassette portables, stereo-radio-cassette portables, hi-fi stereo systems and accessories, television sets, tape recorders, electronic calculators, etc.

|                 |   |
|-----------------|---|
| US\$ 17,500,000 | 31.8% of electronics/<br>electronics-related<br>imports |
|-----------------|---|

- Communications electronics - radio-communications equipment, amplifiers, modulators, etc.; telephone handsets, telephone exchanges, PBX and PABX systems, transmission lines, etc.

|                 |   |
|-----------------|---|
| US\$ 23,250,000 | 42.2% of electronics/<br>electronics-related<br>imports |
|-----------------|---|

- Industrial, instrumentation, and digital electronics - process control instruments, control devices, voltage and current meters, oscilloscopes, signal generators, calculators, computers and their peripherals, digital instruments, etc.

US\$ 14,250,000

26% of electronics/  
electronics-related  
imports

The total average annual value of electronics/electronics-related imports is

US\$ 55,000,000.

Values of imports of electronic products for the three segments described above were investigated by consulting Kenyan Customs documents for 1976 to 1980. The information gleaned from these documents for 1979 and 1980 is presented as Appendix C.

From an analysis of customs data from 1976 to 1980, one observes the following:

- the value of particular imports vary widely and unexplainably from one year to another, making it impossible to establish any trends or growth rates
- for the years 1979 and 1980, imports show a tendency to stabilize around the values shown in Appendix C.

Table 4 shows the market shares of the various exporting countries for the electronics products imported by Kenya. Since companies of the first four countries of Table 4 have the highest stake in Kenya, it is principally with them that Kenya should negotiate new assembly and manufacturing projects to be implanted in the country.

It should be stressed that the market sizes indicated above are the values of imports. A determination of the actual domestic market size based on sales prices in Kenya would require considerably more detailed and up-to-date information than was available to the project team. Analysis of the Customs data, for example, shows that even no coherent unit C & F prices can be determined from the data. Moreover, more complete information on technical specifications would be needed to define just which products are being imported.

TABLE 4: Market share (1979 - 1980) of exporting countries for electronic products imported by Kenya

| <u>EXPORTING COUNTRY</u>   | <u>MARKET SHARE</u> | <u>ANNUAL VALUE OF EXPORTS (US\$)</u> |
|--|---------------------|---------------------------------------|
| England  | 29.1 %              | 16,000,000                            |
| Japan  | 15.5 %              | 8,800,000                             |
| Federal Republic of Germany  | 11.5 %              | 6,300,000                             |
| Holland  | 9.1 %               | 5,000,000                             |
| France   | 9.1 %               | 5,000,000                             |
| Italy  | 7.0 %               | 3,750,000                             |
| USA and Canada   | 6.0 %               | 3,300,000                             |
| Switzerland  | 4.5 %               | 2,450,000                             |
| 10 European countries, not including Eastern Europe                  | 4.5 %               | 2,450,000                             |
| 37 countries, with preponderance of India, Israel and Southeast Asia | 3.7 %               | 2,000,000                             |
| Total  | 100 %               | 55,500,000                            |
|  | =====               | =====                                 |

## 5.2 MAJOR PUBLIC-SECTOR PURCHASERS AND USERS

As indicated by the 42.2% share of imports, communications electronics have a dominant role in the electronics industry of Kenya, and the purchasers and users of such equipment are nearly all in the public sector. Table 5 presents the major customers for communications electronics equipment in Kenya.

The lack of foreign exchange has influenced the buying patterns of these purchasers. To side-step this problem, bi-lateral commitments between Kenya and other governments are concluded which, ultimately, bind the Kenyan purchasers to particular foreign equipment suppliers and which prevent the purchaser from effectively negotiating prices and equipment specifications. World Bank-financed projects as well do not always result in equipment which the purchaser considers to be compatible with long-term development. The result, and continuing danger, is that equipment and the relevant test equipment bought in one period will not be compatible with that bought in the next, and that development of the electronics industry in Kenya will not proceed in an orderly and systematic way.

## 5.3 MAJOR PRIVATE-SECTOR PURCHASERS AND USERS

The major hotels are important customers of the electronics industry and are obliged to buy local products. An order from a large hotel to supply all the hotel's radios or television sets, for example, could be the deciding factor in an assembler's future. Hotels are important purchasers as well of hotel-type telephone exchanges and telephone handsets.

## 5.4 INDIVIDUAL PURCHASERS OF DOMESTIC ELECTRONIC PRODUCTS

The individual purchaser is typically an urban dweller and is caught between inflation and taxes. Regardless of his salary, inflation or taxes or both are eroding his purchasing power. With prices of domestic electronics products in Kenya at 2 to 3 times the European price (even after haggling), purchasing decisions are not spontaneous. Nevertheless, the many domestic electronics stores in Nairobi are full of the latest products. In fact, some customers seem

TABLE 5: Major Kenyan public-sector purchasers and users of electronic products

| <u>PURCHASER/USER</u>  | <u>ACTIVITY</u>   |
|--|---|
| Kenyan Post & Telecommunications (PTT) <sup>1)</sup>   | <ul style="list-style-type: none"> <li>- Users of telephone exchanges</li> <li>- Approving of telephone handsets and telephone exchanges</li> <li>- Testing and repair of certain telecommunications equipment</li> </ul> |
| Department of Defense <sup>1)</sup>  | <ul style="list-style-type: none"> <li>- Users of military-specification radio-communications equipment, other various electronic equipment</li> </ul>  |
| Kenya External Telecommunications Co., Ltd. (KENEXTEL) <sup>1)</sup><br>(Responsible for telecommunications links between Kenya and the world) | <ul style="list-style-type: none"> <li>- Users of sophisticated telecommunications equipment</li> </ul>   |
| Police <sup>2)</sup>   | <ul style="list-style-type: none"> <li>- Users of police-specification radio-communications, other various electronic equipment</li> </ul>  |
| Voice of Kenya <sup>2)</sup><br>(Radio and television broadcasting)  | <ul style="list-style-type: none"> <li>- Users of radio and television broadcasting-, monitoring and control-, test equipment</li> <li>- Testing of certain equipment</li> </ul>  |

1) Organisation contacted and interviewed in-depth

2) Organisation contacted but not interviewed in-depth

to be willing to pay a considerable premium for a product with gadgetry making it only marginally different from the next-lower-priced model. This is true for the most popular (and best selling) domestic electronics products in Kenya, radio-cassette portables, and even more so for stereo radio-cassette portables. However, there does appear to be a sound, basic, and large market for the portable radios and radio-cassettes now assembled in Kenya. In 1974, there were 510,000 radios in Kenya or about 39 per 1000 people.<sup>1)</sup>

There is no difference between the retail sales prices of domestic electronic products assembled in Kenya and those imported as finished products. Thus, the customer has no price-incentive to buy the Kenyan product. Furthermore, it is not clear whether the customer even knows when he is buying a product assembled in Kenya.

Television in Kenya, even in Nairobi, is a luxury out of reach of most of the population, and its popularity is probably somewhat restrained by the lack of choice of programmes. In 1974, there were about 37,000 television sets in Kenya or about 3 sets per 1,000 people.<sup>2)</sup>

Nairobi is host to a large number of United Nations personnel, especially of UNEP and UNESCO, but this group, while enjoying high incomes, has the right to import domestic electronic products tax-free and cannot be counted as customers in the domestic electronic market.

## 6. FUTURE MARKET FOR ELECTRONICS PRODUCTS IN KENYA

This chapter presents indications of likely future market developments for each market segment.

1) 2) Source: The World in Figures, The Economist

## 6.1 DOMESTIC ELECTRONICS

This market segment will grow mainly as a result of population growth, which appears to have reached 4% annually. If inflation is brought under control and if the Kenyan economy picks up pace, there could be shifts from the lower- to middle income groups which would expand the market base.

The main growth may come in the urban-industrial centers other than Nairobi: Nkuru, Kisumu, Eldoret, Thika, and Mombasa where income growth may be more rapid than in Nairobi.

The best-selling products today, portable radios and radio-cassettes, will continue to sell well for several years, perhaps then giving way to similar but higher-fidelity models.

Sales of television sets should experience the largest growth rate of any domestic electronics product in Kenya for the next 5-10 years, with the conditions that the sets become more affordable and that the programming becomes more varied.

## 6.2 COMMUNICATIONS ELECTRONICS

The modernisation of three types of telephone equipment is planned:

- Replacement of operator-assisted dialing by semi-automatic and automatic exchanges in rural areas
- Introduction of electronic exchanges (although the wiseness of this investment is questionable)
- Replacement of telephone handsets, including those at large facilities such as:
  - . Kenyatta Centre
  - . Kenyatta Airport.

It is important to stress that the change from cross-bar to electronic exchanges will not suddenly open-up



the market. Plans call for progressive replacement. From 1981 to 1983, some trunk lines, some automatic exchanges, some trunk dialing, and some direct dialing facilities are due to be installed, and the specifications of the first stage should be ready next year. The change to digital exchanges is planned as a five year programme dependent on World Bank financing. It must, however, be stressed that the resources to be committed to this modification could be much better utilised in Kenya in productive investments. Countries like Switzerland have not yet taken this step which appears to be premature. In any case, the local electronics industry, except for sales and service organisations, would have very little part in this operation.

Non-military radio-communications - consisting mainly of police radio, national park radio service, security agency radio, and some private radio - will continue to grow, and will probably be subjected to only a minimum of encroachment from the growing telephone system. It can be expected that at least the combined total (VHF + UHF sets) of about 1,000 sets sold currently in Kenya each year will continue to be sold in the future years.

### 6.3 INDUSTRIAL, INSTRUMENTATION AND DIGITAL ELECTRONICS

This market segment will continue to be supplied by imports through locally-established sales and service organisations.

The industrial electronics market segment, currently very small, will hardly grow within the next ten years.

Digital electronics, presently a small market, appears to be growing fairly rapidly as business and other organisations modernise.

The outlook for the subsegments of instrumentation electronics in Kenya is as follows:

- Telecommunications (signal generators, frequency references, other calibration equipment): Customers are government agencies such as Extelcom, Post and Telecommunications, Civil Aviation, and Voice of Kenya. This market will enjoy steady growth.

- General test and measuring instruments: The customers are mainly (80%) those cited above for telecommunications, with the remainder (20%) being various private customers. This market as well should benefit from continued growth.
- Scientific instruments: The customers are the many research organisations (about 20) located in Kenya such as ILRAD - International Laboratory for Research on Animal Disease - and the Kenya Agricultural Research Centre. This market depends largely on research budgets, and will remain small with fluctuations.

It is felt that none of the electronics products in this segment, Industrial, Instrumentation and Digital Electronics, can be reasonably produced in Kenya within the next five years.

7. SHORT-TERM STRATEGY FOR KENYA: MANUFACTURE OF CERTAIN ELECTRONIC AND NON-ELECTRONIC COMPONENTS TO INCREASE LOCAL CONTENT

After careful analysis of the existing conditions of the electronics industry in Kenya and the current situation and prospects of world-wide electronics manufacturing and marketing, we conclude that, in the short term, the most appropriate method for stimulating the development of the industry in Kenya is the increasing of local content of locally-assembled products. This can be done best by first selecting electronic- and non-electronic components common to all or nearly all electronic products already assembled or likely to be assembled in Kenya and then devising policies and programmes to ensure the start-up and continuing of their manufacture and marketing.

Typical non-electronic components which could be manufactured in Kenya are presented in Table 6, while the electronic components best suited for manufacturing are shown in Table 7. An illustration of the classification of components into "electronic" and "non-electronic" is shown in Table 8, taking the electronic hygrometer as an example.

TABLE 6: Non-electronic components which could be manufactured in Kenya

1. SWITCHING - TRIPPING - PROTECTION COMPONENTS

- Selector switch
- Reversing switch
- Rotary switch
- Push-button switch
- Disconnecting switch
- Earthing switch
- Position switch
- Breaker, tripping device
- Contactor
- Fuse
- Relay (protective, measuring, auxiliary, signal, etc.)

2. CONNECTION COMPONENTS

- Terminals
- Earth terminal
- Fixed contact
- Plug
- Plug adaptor
- Pin
- Socket contact
- Cable entry
- Bush
- Compression gland
- Fuse base
- Socket-outlet
- Socket-outlet adaptor
- Connector
- Flexible lead connector
- Non-reversible connector/plug/extensions

TABLE 6: (cont.) Non-electronic components which could be manufactured in Kenya

- Holder/bayonet holder/screwed holder
- Various copper wires and cables

3. COMPONENTS USED FOR ASSEMBLY

- Various supporting and suspension parts
- Moulded/cast products of all types in cast iron and in steel, in non-ferrous metals and alloys
- Flat products
- Tubes, ferrous and non-ferrous
- Coupling pieces
- Screws, bolts, etc.
- Metallic and plastic cases (cover and base)
- Metallic/chromed/plastic push-buttons
- Soldering material

TABLE 7: Electronic circuitry components which could be manufactured in Kenya

- Printed circuit boards
- Transformers
- Toroidal transformers
- Auto-transformers
- Potentiometers
- Voltage regulators
- Heat dissipators

TABLE 8: Classification of components of an electronic device into "electronic" and "non-electronic";  
Example: Electronic Hygrometer

ELECTRONIC COMPONENTS

9 resistors, of which 2 variable  
4 capacitors, of which 1 variable  
2 diodes  
1 Zener diode  
2 integrated circuits  
1 printed circuit  
1 moisture detector

NON-ELECTRONIC COMPONENTS

2 reversing switches  
connectors  
wiring  
1 dry cell battery  
1 galvanometer  
supports  
screws and bolts  
1 case (cover and base)

DEFINITIONS (for this report)

ELECTRONIC COMPONENTS

All unitary elements whose proper connection determine the characteristics of an electronic circuit.

NON-ELECTRONIC COMPONENTS

All other unitary elements entering in the composition of an electronic device.

## 7.1 ECONOMIC JUSTIFICATION OF THE STRATEGY

It must be pointed out that our recommendations are not made because we expect from this initiative a cost/price advantage. It would certainly be less expensive to continue importing these parts which are elsewhere manufactured automatically in very large quantities and therefore produced under optimum conditions.

Our recommendations are based on three main considerations:

- They imply the acquisition of know-how and the training of personnel in sectors which will later on allow the expansion into other types of activities without unduly soliciting the balance of trade. The recommended manufactures are indeed basic to many of the products of light manufacturing industries.
- They can lead to an increase in the added value of the electronic products presently assembled or manufactured in Kenya.
- They imply some employment.

The Government of Kenya should be made aware that the existing international situation of the manufacturing and marketing of electronic components and products as well as non-electronic components excludes exports of any of these components to a developed country when that component or product is not produced by an export-processing-zone controlled by one of the international electronics companies. Even these zones are going to be used less and less by the international companies as manufacturing "platforms". The trend is to regroup manufacturing at the "home" (the largest) markets and to automate the plants.

The export from Kenya of electronic-products and components as well as non-electronic components to other developing countries is hampered by protectionism and by severe competition from other sources. Such export is not excluded, but it must be recognized that the potentials are small, uncertain and subject to many factors beyond the control of the Kenyan manufacturing and marketing operation.

Presented below is the explanation of the economic reasons that the components of Tables 6 and 7 were chosen over others.

Electronic components other than those of Table 7 cannot be manufactured economically in Kenya because their manufacture requires:

- markets which are much larger than the Kenyan market and expensive, high-volume equipment
- or, the set-up of export processing zones aimed at export to predetermined areas fitting into the global plans of international electronics companies.

Both of these alternatives are unsuitable, given the small size of the Kenyan market and the surplus of export-processing-type electronics manufacturing world-wide.

Private industry in Kenya has not undertaken the manufacture of the components of Tables 6 and 7 apparently because of:

- perceived low-profit potential
- lack of a commercial concept (for product line, product mix, manufacturing, testing)
- lack of market knowledge
- prohibitive start-up costs
- prohibitive testing/quality control costs relative to other costs
- problems with importing the required equipment
- other investment priorities.

These constraints are preventing the electronics industry in Kenya from adding another 30% to the local content of locally-assembled electronics products.

A market already exists in Kenya, although the size of this market will still have to be ascertained<sup>1)</sup> for the electronic- and non-electronic components of Tables 6 and 7, which are all presently imported in Kenya.

---

1) A detailed feasibility study is recommended in Chapter 8.2

Moreover, the market is diversified: It is composed of several different industrial fields which are not at all likely to experience simultaneous business slumps.

The investments in capital under the strategy are moderate and the investments in men are relatively high. There is no high cost to be foreseen for a transfer of elaborate technology (see Chapter 7.2 below).

## 7.2 TECHNICAL JUSTIFICATION OF THE STRATEGY

Together, the non-electronic components and electronic components of Tables 6 and 7 are technically sound for manufacture in Kenya, because these components:

- correspond to highly-developed standards, and technology and design acquisition consists simply of the acquisition, study, and mastering of the major national and international sets of standards
- do not require elaborate manufacturing facilities; in fact, the types of equipment required are most likely already existing in Kenyan businesses, as the project team was able to at least partially confirm. The required types of operations are:
  - . plastics moulding and forming
  - . metal casting, forging, pressing, stamping, punching, flanging, cupping
  - . sand-blasting of metal sheeting; bending, cutting, curving; welding, soldering, brazing; surface treatments; heat treatments
  - . preparation of electrical insulating materials, wires, cables; execution of magnetic circuits and windings; printed circuits manufacture
  - . machining including tracing, turning, drilling, boring, milling, grinding, planing.

Because of the low unitary volume and weight of the products, the production may be designed for the



manufacture of small standardised elements in small, medium and even large series. While the moulding machines are already of a certain size, one cannot speak truly of heavy-machine-tools requiring elaborate supporting structures and lifting facilities.

All the manufacturing techniques applied in these plants are conventional and are easy enough to understand by studying the technical notices delivered on purchase of the machines. Product specifications are not difficult to follow, except that the precision required demands care and discipline in the carrying out of the manufacturing process.

The components do not require expensive or rare raw materials.

For the proper functioning of the manufacturing process, no specially skilled or trained personnel are required.

Testing and control of the manufactured components, which are of the utmost importance, will require, as for any other manufactured items, some relatively expensive equipment or installations manned by highly qualified personnel. This testing and control function can be carried out by a separate, centralised institution.

This function is an essential part of the Kenya Electronic Development Centre which will be proposed and explained in detail in the remainder of this report.

### 7.3 ROLE OF THE PROPOSED KENYA ELECTRONIC DEVELOPMENT CENTRE (KEDEC)

As introduced above, KEDEC should have a centralised testing and control function. The testing and control services provided by KEDEC will be valuable services and the users of these services should pay for them. An equitable method for determining the service charges should be elaborated, and it should be determined very early in a feasibility study of KEDEC itself, whether the testing and control function of KEDEC can be auto-financed.

KEDEC would also have an essential monitoring and policy formulation function, in that it would be charged with helping to steer the course of the electronics industry in Kenya. In this role, it would have many responsibilities including continuously studying the market and determining new product lines essential for the growth of the industry.

Before the actual inauguration of KEDEC, IPD would have to perform a detailed feasibility study to determine precisely the component product lines and product mixes which could be manufactured initially for the Kenyan market. Execution of this study by IPD would remove one of the constraints to the undertaking of the manufacture of the components by the private sector.

The offering of other appropriate incentives (see Chapter 8.3) may be necessary to spur the private sector to action. In any case, the entrepreneurial function in the establishment of the manufacturing of components in Kenya is more appropriately the affair of the private sector, because it:

- already has the necessary entrepreneurial talent
- is already well-represented in electronics
- has access to capital
- has already shown its willingness and ability to bear risk.

The private sector should be encouraged to undertake the entrepreneurial function and, indeed, should be given priority over KEDEC for it.

If it is determined, on presenting the strategy to private industry and after IPD's detailed feasibility study and the offering of appropriate incentives, that private industry is not ready and willing to undertake the entrepreneurial responsibility for establishing the manufacture of the selected components, then KEDEC's role might have to be reviewed. In this case, KEDEC could take on the overall responsibility for the organisation of the manufacturing of the selected components, letting contracts to existing Kenyan businesses capable of performing the operations described in Chapter 7.2.

A detailed programme for KEDEC is given in Chapters 8.2 - 8.6.

## 8. PROPOSED ACTIONS FOR ENCOURAGING THE DEVELOPMENT OF THE ELECTRONICS INDUSTRY IN KENYA

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Generally speaking, it would be a wise government policy to favour the development of radio and television. These media are important in promoting education and disseminating information, powerful tools for promoting national unity and for preparing the population for the transition to tomorrow's world.

More specifically, the sectors of the electronics industry treated in this report have two common characteristics:

- the technologies have reached a plateau, a fact which justifies the transfer of technology
- the manufacture is essentially based on mass production, in itself a severe handicap to a transfer of technology.

However, the manufacture can be roughly divided into two steps:

- the manufacturing of components, which is highly automated
- the assembling of components into finished electronic products, which has been, until lately, to a great extent a manual process.

In fact, the manual nature of assembling has justified the fact that in past years almost all assembling of consumer electronics has been carried out in countries of low-cost manpower.

Recently, however, an evolution has been occurring: More and more automation is also being applied to assembling, notably to bonding. This evolution results essentially from:

- the introduction of electronic automation (rather than mechanical) following the reduction of the cost of automation even for manufacturing in smaller series
- parallelly, the increase of salaries in the Far East where assembling operations were concentrated.

This evolution is a fact and should caution the developing countries in their desires to be able later on to export more and more added value to the markets of developed countries.

In addressing the markets of developing countries, however, the problem is different: Political considerations dominate and it must be expected that markets will be furnished more and more by locally-manufactured finished products based, for a long time to come, on manual assembly.

To what extent will export from Kenya to these markets be conceivable? The answer lies partially in one observation: All of these countries experience sizeable deficits in their trade balances with the exception of the oil producing countries. However, these latter countries industrialise and their consumers tend to buy the latest electronic products from the developed countries.

There would seem to be only one way out of this predicament: The development of bigger markets through the distribution of production within free trade areas. This has been attempted (for example, in the East African Community), but politics have neutralised these attempts in almost every case.

Therefore, one reaches the conclusion that, in the short term and with possible occasional exceptions, Kenya should only reckon with its own internal markets.

It is conceivable that larger markets could open up in the long term.

Then, however, those countries which have the best competitive bases will be clearly better placed to furnish such markets. This is a serious incentive to improve in Kenya a situation which at present warrants some sizeable corrections.

Other incentives will be that the lower the costs and the better the products, the bigger will be the chances to increase market share. In turn, the bigger the market, the lower are the costs. Production and distribution efficiencies and product quality should thus be the main objectives of the infant electronics industry in Kenya. The government, however, has to contribute sizeably to bring about this improvement.

In Chapter 4, it was indicated that various problems of the electronics industry in Kenya are associated with, or are the direct consequence of, certain government policies. Also cited were a lack of consistency and coherency in government policies for the regulation and protection of the electronics industry.

It is appropriate to assign priorities to the proposed actions, and highest priority should be given to correcting and complementing certain government policies before proceeding to the other proposed actions. In fact, appropriate policies might well do more for the development of the electronics industry in Kenya than the proposed Kenya Electronics Development Centre.

#### 8.1 MODIFY CERTAIN POLICIES

The short-comings of certain government policies have one thing in common: Motivation by an extremely short-term view. In contrast, the private sector in electronics has matured greatly since its early days, businessmen's views changing from short-term, high gain to the long-term competitive approach. This change in the business community has not been completely effected, but the government should be aware of it and fashion its regulatory and protective policies in accordance.

Another motivation often behind government policies is foreign exchange control. Much effort is still needed to prevent short-term foreign exchange savings from undermining long-term development.

The following modifications to policies would go a long way towards preserving the existing electronics industry and encouraging its growth:

- After consulting representatives of the electronics industry in Kenya and tariff experts available to the government from international organisations, formulate appropriate rates and maintain these rates. Any changes should first go through the consultative process just described and be published well in advance of their date of going in force.
- Eliminate all arbitrariness in the granting of import licenses, giving due consideration to importations of equipment destined for use in projects aimed at increasing the local content of electronics products assembled in Kenya.
- Establish with the aid of the Kenyan Bureau of Standards and other experts as required, and in consulting representatives of the electronics industry in Kenya, precise, clear, and readily useable definitions (to be used by the Kenyan Customs) of all electronic products or electronics-related products which pass through the Kenyan Customs and which are basic to electronics products assembled in Kenya or imported as finished goods.
- In certain electronics industry branches, notably telecommunications, make sure that projects undertaken by governmental agencies such as the Post and Telecommunications proceed in orderly, incremental steps so that the market for equipment, in turn, grows in an orderly, incremental way. Guarantee minimum equipment purchases each year by governmental agencies of specified locally-made or locally-assembled electronics products so as to encourage and facilitate the business planning of local-assembly or manufacturing projects. Examples of such projects are local assembly of telephone handsets and certain telephone exchanges.
- Expedite the official processing and scrutinising of applications and propositions for the local assembly or manufacture of electronics or electronics-related products.

- Undertake to promote price competition at the wholesale and retail levels of all electronics- and electronics-related equipment, and to guard against such unfair practices as dumping and aligning of prices (in formal cartels)
- Streamline the procedures in the dealings with governmental agencies of all parties to the electronics industry in Kenya.
- Constantly verify that no dis-incentives to the development of the electronics industry find their way into official policies, programmes, or procedures. Consultation with the director of the proposed Kenya Electronics Development Centre will facilitate this verification.

## 8.2 PERFORM DETAILED FEASIBILITY STUDIES: LOCAL MANUFACTURE OF SELECTED COMPONENTS; KEDEC

The purpose of the first study, to be prepared by IPD assisted by experts provided by UNIDO, is to determine precisely which of the components of Tables 6 and 7 could be manufactured economically in Kenya in two different cases:

- Case I: The private sector undertakes the entrepreneurial responsibility for the organising of manufacture and marketing
- Case II: KEDEC takes on the entrepreneurial responsibility.

The study for each case should be a detailed feasibility study indicating product lines, product mixes, market absorption schedules, required investments, equipment specifications, manpower requirements, start-up schedule, and financing methods. The latter would most likely be different for Case I and Case II, and both must be examined in detail.

At the same time, a detailed study of the feasibility of KEDEC itself should be undertaken, mainly to determine if the proposed services of KEDEC, especially the testing and control services, can be auto-financed. The study should have as one of its results a formal proposal for the imposition of service charges on users of KEDEC's services and show calculations of the service charges required.

The results of the studies should be presented to a large formal meeting of all representatives of the electronics industry in Kenya in the style of the meeting held by IPD on 15th April 1981. Priority should be given to implementing the results of the feasibility study for Case I, where the private sector assumes responsibility for the manufacture and marketing of components.

### 8.3 FORM A SMALL ENTREPRENEURIAL TEAM TO ORGANISE THE MANUFACTURE OF SELECTED COMPONENTS

A reasonable period of time should be allowed for private industry representatives to prepare their responses to the feasibility studies. The responses should be studied by IPD assisted by an expert provided by UNIDO, one of the same experts involved in the feasibility studies. Any proposed fundamental changes should be examined carefully.

An objective of IPD in this process should be to determine whether a local businessman would be willing to undertake the commercial/entrepreneurial functions of buying (wholesale), marketing, and distributing the components manufactured under the strategy.

Next, IPD should agree on a definitive set of incentives for private industry to launch the manufacturing operation. The incentives might include attractive financial arrangements for the acquiring of the necessary equipment, such as:

- purchase of the equipment by the future KEDEC or IDP and leasing on favorable terms to the private industry commercial partner or to the selected manufacturers



- guaranteed loans at favorable rates for the purchase of the equipment by the private industry commercial partner or the selected manufacturers.

Further incentives may be necessary and would likely be limited to guaranteed purchases by IPD/KEDEC of minimum quantities of the output of manufactured components. In this way, the government would underwrite part of the commercial risk of the venture.

Finally, IPD should call for offers from the private sector to participate in the venture and select and negotiate final terms with prospective manufacturers.

In the event that no private industry commercial entrepreneurial partner can be found, KEDEC could undertake the buying, marketing, and distribution of the manufactured components, at least until an industrial partner is ready to take over.

Figure 1 shows the roles of KEDEC and the private sector commercial partner in the manufacture of components, for the case where the private sector does not take on manufacturing responsibility.

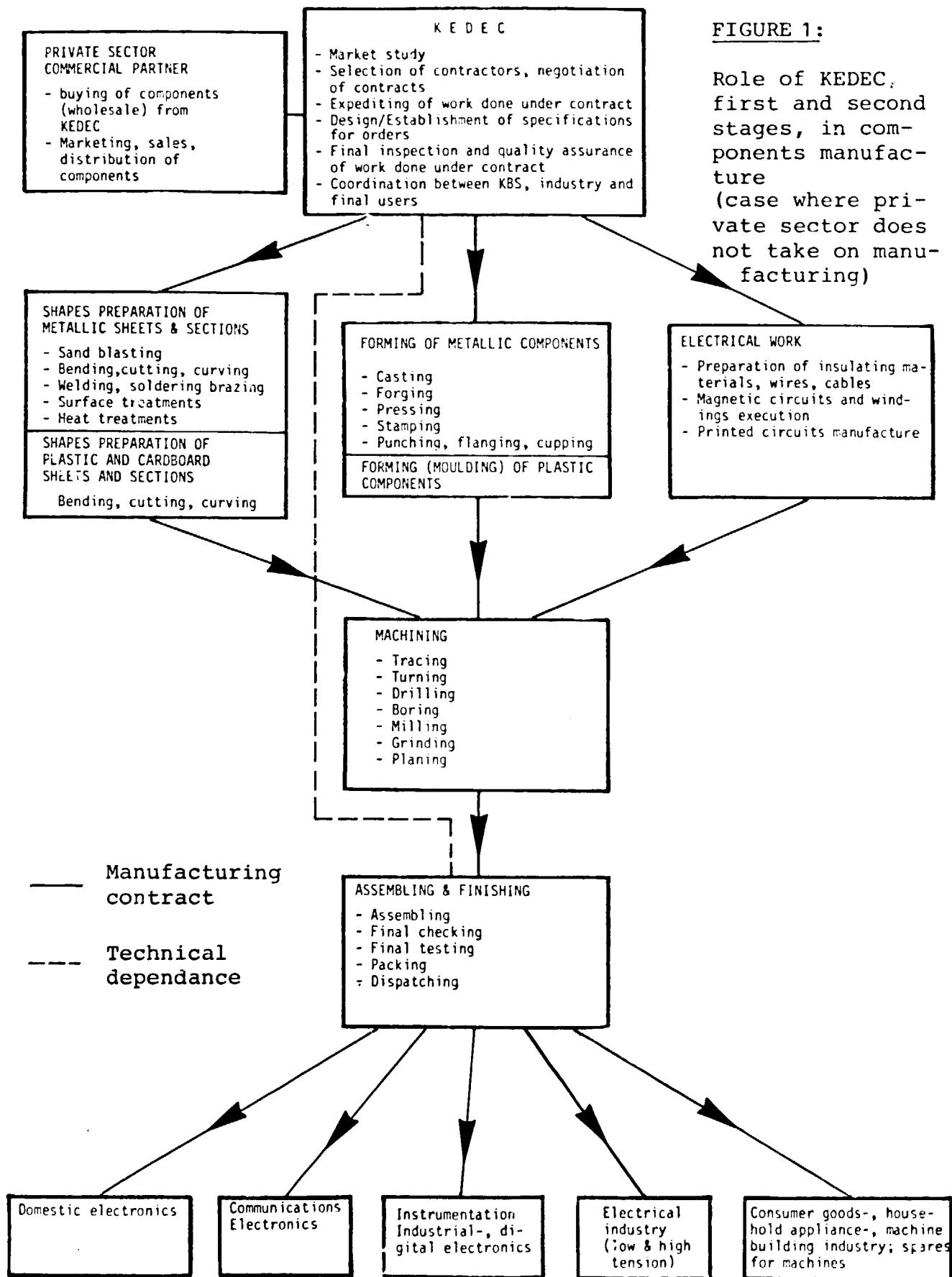
The tasks involved in the start-up of the manufacture of the selected components are shown as a flow-sheet in Table 9.

The different stages in the implementation of the proposed KEDEC are shown in Table 10.

#### 8.4 IMPLEMENT THE FIRST STAGE OF THE PROPOSED KENYA ELECTRONIC DEVELOPMENT CENTRE (KEDEC)

One of the main functions of KEDEC during all stages of its implementation is to be the control and testing of components manufactured in Kenya, of electronic products assembled in Kenya, and of certain electronics equipment imported by Kenya.

The objectives of centralising the investment (as was done in Switzerland for the watch industry) in costly equipment and highly skilled personnel required for the control and testing functions of a major part of the electronics industry in Kenya are as follows:



**FIGURE 1:**

Role of KEDEC, first and second stages, in components manufacture (case where private sector does not take on manufacturing)

TABLE 9 : Definition and flowsheet of tasks for the start-up of KEDEC and for adding product lines requiring no development work

| TASKS   | RESPONSIBILITY  |  |
|---|-----------------|--|
|   | START - UP      | KEDEC 1st & 2nd STAGE                          |
| 1. Perform detailed market analysis: isolate product line             | START - UP TEAM | Commercial Dept.                               |
| 2. Isolate a product mix for the product line                         |                 | Commercial Dept.                               |
| 3. Obtain standards   |                 | Technical Dept.                                |
| 4. Set product specifications   |                 | Technical Dept.                                |
| 5. Search equipment, obtain specifications, prices etc.               |                 | Technical Dept.                                |
| 6. Re-contact potential customers                                     |                 | Commercial Dept.                               |
| 7. Finalise specifications  |                 | Technical Dept.                                |
| 8. Book tentative orders <sup>1)</sup>                                |                 | Commercial Dept.                               |
| 9. Contact potential contractors , negotiate collaboration with KEDEC |                 | Commercial Dept.                               |
| 10. Order equipment   |                 | Commercial Dept.                               |
| 11. Set up equipment  |                 | Commercial Dept.                               |
| 12. Establish working methods and procedures                          |                 | Control/Testing Dept./Contractor <sup>2)</sup> |
| 13. Make initial runs (execute typical manufacturing start-up)        |                 | Control/Testing Dept.                          |
| 14. Perform tests   |                 | Control/Testing Dept.                          |
| 15. Refine working methods and procedures                             |                 | Control/Testing Dept.                          |
| 16. Perform final tests   |                 | Control/Testing Dept.                          |
| 17. Execute orders  |                 | Contractor                                     |
| 18. Expedite orders and control contractor's performance              |                 | Commercial Dept.                               |
| 19. Perform final inspection  |                 | Control/Testing Dept.                          |

**TABLE 9:** (continued) Definition and flowsheet of tasks for the start-up of KEDEC and for adding product lines requiring no development work

| TASKS   | RESPONSIBILITY   |                                |
|---|--|--------------------------------|
|   | START - UP   | KEDEC 1st & 2nd STAGE          |
| 20. Deliver goods                               | S<br>T<br>A<br>R<br>T<br>-<br>U<br>P<br><br>T<br>E<br>A<br>M | Commercial Dept. <sup>3)</sup> |
| 21. Perform acceptance tests                    |  | Control/Testing Dept.          |
| 22. Maintain follow-up contacts with customers  |  | Commercial Dept. <sup>3)</sup> |
| 23. Produce sales brochure for the product line |  | Commercial Dept. <sup>3)</sup> |
| 24. Market product line to other customers      |  | Commercial Dept. <sup>3)</sup> |
| 25. Book new orders                             |  | Commercial Dept. <sup>3)</sup> |

- 1: Tentative orders must be of sufficient volume and value to cover the level of risk established in advance by all parties to KEDEC.
- 2: The term "contractor" means the party who manufactures for KEDEC and under contract to KEDEC electronic or non-electronic components selected and specified by KEDEC for delivery to third parties.
- 3: These tasks are to be the responsibility of the private sector commercial partner if one can be found.

**TABLE 10:** Definition of the stages of KEDEC and implementation timing

| STAGE        | IMPLEMENTATION TIMING | MISSION   | REQUIRED TECHNICAL AND FINANCIAL ASSISTANCE  |
|--------------|-----------------------|---|--|
| Preparation  | 1981                  | <ul style="list-style-type: none"> <li>- Contact and interview in-depth the organisations listed in Table 1 and 2</li> <li>- Study in detail the market for components listed in Table 6 and 7; perform detailed feasibility study of their manufacture in Kenya</li> <li>- Recruit start-up team</li> </ul>  | <ul style="list-style-type: none"> <li>- Market study expert</li> </ul>  |
| Start-up     | 1982                  | Organise the manufacture under contract of selected initial product line of components (see Table 9 for flowsheet of tasks)   | Elaboration of appropriate equipment ownership and financing scheme  |
| First Stage  | 1983                  | <ul style="list-style-type: none"> <li>- Implement formal KEDEC organisation and install the Control and Testing Unit in its own building</li> <li>- Expand product lines of components manufactured under contract</li> <li>- Begin function of making policy recommendations on electronic industry development</li> </ul>  | <ul style="list-style-type: none"> <li>- Establish KEDEC charter, job descriptions, procedures, management information system, recruiting</li> <li>- Elaboration of KEDEC building ownership and financing scheme</li> </ul> |
| Second Stage | 1986 <sup>1)</sup>    | <ul style="list-style-type: none"> <li>Add "Development" function to Control and Testing Unit: development of appropriate electronic products for manufacture under contract, assistance in launching small scale enterprise (electronics or related) and assistance to existing firms</li> <li>- Begin to undertake industry-wide quality assurance</li> </ul>                                       | <ul style="list-style-type: none"> <li>- Elaboration of underwriting scheme for development budget</li> <li>- Financing of equipment</li> </ul>  |
| Third stage  | 1988-90               | <ul style="list-style-type: none"> <li>- Strengthen technical skills of Control and Testing Unit to prepare it for dealing with sophisticated telecommunications equipment</li> <li>- Examine possibility of transferring commercial-technical-, and development units to private sector as a consulting electronics engineering firm</li> <li>- Undertake industry-wide quality assurance</li> </ul> | Elaboration of scheme for evaluating and selecting transfer of technology 2)   |

1) The implementation of the second stage may start earlier if warranted by commercial opportunities.

2) Tentatively, to be effected by negotiating through diplomatic channels a consultancy contract with an established telecommunications testing, research and development centre in a second country.

- to remove the obstacles of a major capital investment (testing and control equipment) and of a major cost (highly skilled personnel) from the path of new electronic products assembly or manufacturing ventures in Kenya
- to upgrade the quality and scope of the control and testing which is currently available to the industry through individual firms' "in-house" capabilities
- to establish standards to be used in the manufacture of components in Kenya
- to establish uniformity of, and a reference for, the control and testing functions, which would enhance the overall credibility of the industry, the saleability of its products, and its ability to attract new investments.

Also a constant role of KEDEC will be the coordination of the development of the electronics industry in Kenya among the private sector, final users of electronic products, the governmental organisations including the Kenyan Bureau of Standards.

The director of KEDEC will spend a good deal of his time determining industry problems and proposing solutions. During the first stage of KEDEC, the director should begin making policy recommendations to relevant governmental agencies on the development of the electronics industry.

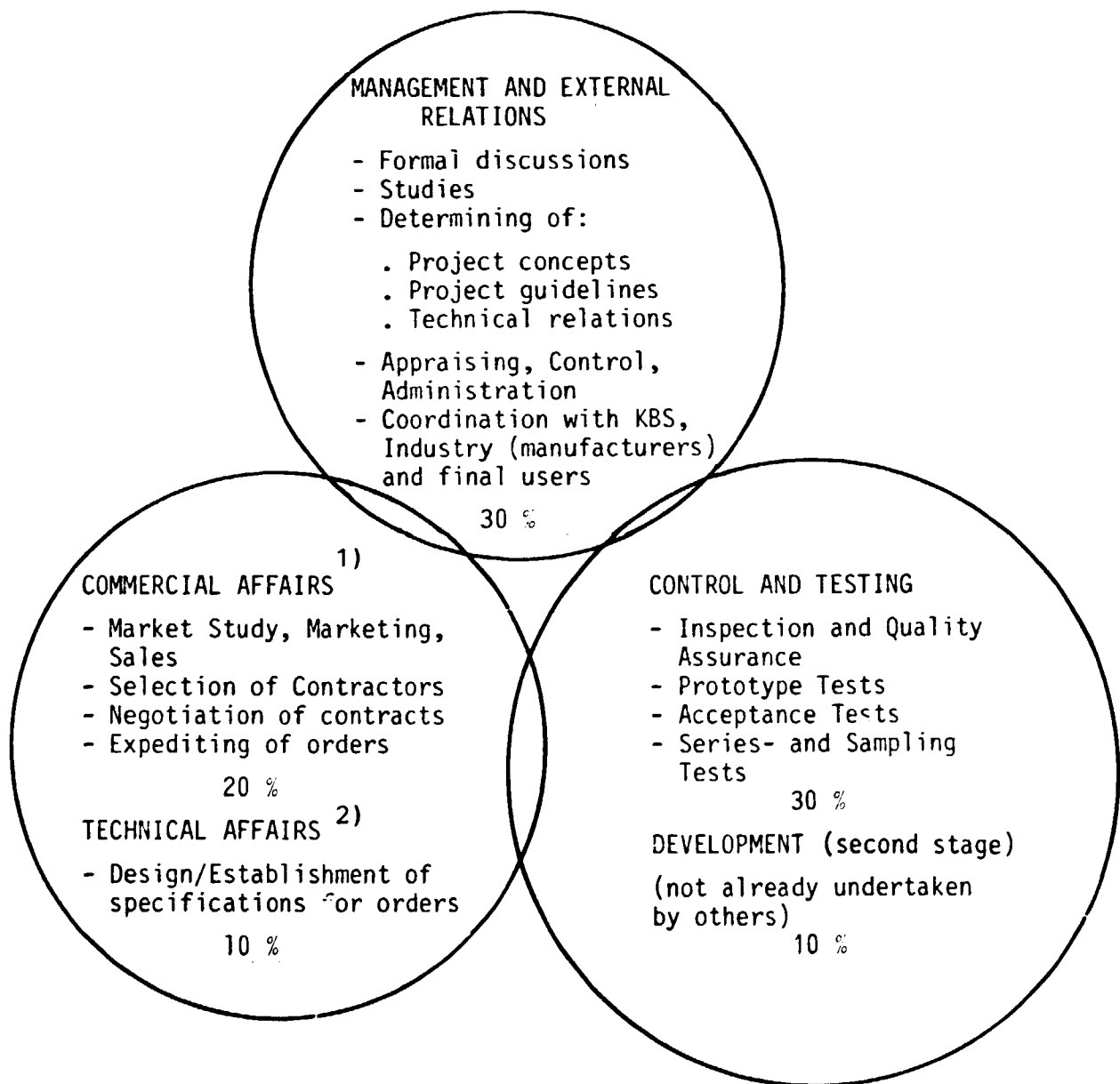
The complete set of functions of KEDEC during the first stage is shown in Figure 2, which also shows the work-load distribution of the functions.

The proposed organisational structure for executing these functions is given in Figure 3, while Table 11 sets out the definitions of tasks of the various departments of KEDEC. Again it should be noted that the Commercial Department only becomes part of KEDEC if private industry declines this role in an arrangement with KEDEC. In any case, the tasks are as defined.

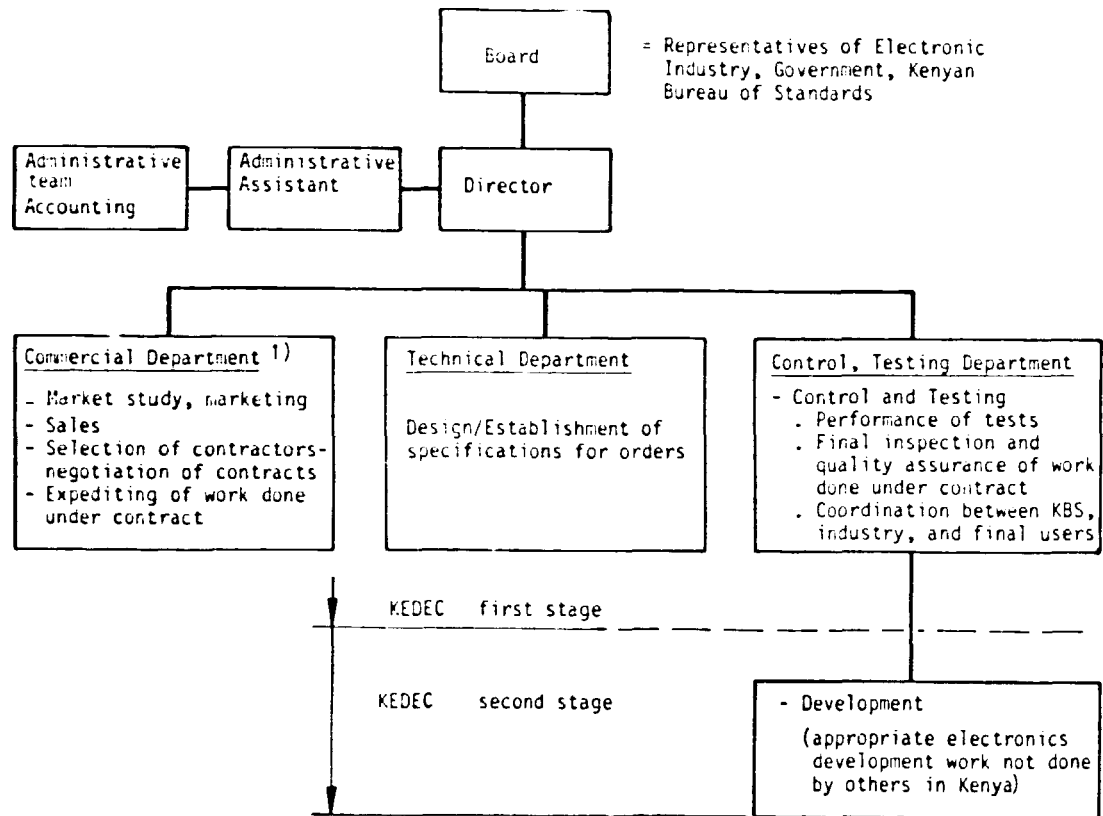
KEDEC staff requirements up to the end of the first stage of KEDEC are shown in Table 12.

A goal of the first stage is to install the Control and Testing Unit in its own building.

**FIGURE 2:** Work load (man-hour) distribution of the Kenya Electronic Development Centre (first and second stage)



- 1) Marketing and Sales are functions of KEDEC to be undertaken only if private industry declines the responsibility.
- 2) Function to be carried out as consulting service by KEDEC if private industry accepts commercial function.



**FIGURE 3:** Organisation chart, KEDEC first and second stages

1) Marketing and sales are optional functions of KEDEC, to be undertaken only if private industry declines the responsibility



TABLE 11: Definitions of tasks of the Commercial-, Technical-, and Control, Testing and Development Departments

COMMERCIAL DEPARTMENT<sup>1)</sup>

- Continuously study, in a detailed and systematic way, the present and future market for components (as defined in Tables 6 and 7 of this report), taking into account all of the local companies (electronic or not) likely to be users of such components, and visiting these companies to determine their present and likely future needs: Product types and specifications, quantities, delivery time schedules.
- Isolate product lines and product mix for each product line
- Contact and evaluate potential contractors; negotiate collaboration with KEDEC
- Order and supervise set-up of equipment
- Book orders<sup>2)</sup>
- Study the offers of the pre-selected subcontractors and award the orders
- Send the order confirmations to the customers
- Expedite orders, that is, compare the progress of activities with a predetermined time-schedule, detect and analyse activities which might entail delays, suggest constructive solutions in order to meet the deadlines of the time schedule
- Control contractor's performance
- Collect payments from customers, pay bills<sup>2)</sup>
- Maintain follow-up contacts with customers<sup>2)</sup>
- Produce sales brochures for each product line<sup>2)</sup>
- Market product lines to new customers<sup>2)</sup>

1: For Flowsheet of tasks in the process of commercialising a selected product line, see Table 9.

2: These tasks to be performed by private sector commercial partner if one can be found.

TABLE 11:(continued) Definitions of tasks of the Commercial-, Technical-, and Control, Testing and Development Departments

- Book new orders <sup>2)</sup>
- Undertake full managerial responsibility for the proper commercial functioning of KEDEC

TECHNICAL DEPARTMENT

- Obtain relevant standards
- Set and finalise product description and specifications stating:
  - . Materials (chemical-, mechanical-, and physical properties)
  - . Dimensions with their tolerances and surface qualities or treatments
  - . Mechanical and electrical characteristics of the finished products
  - . Manufacturing processes, times, and costs
  - . Outline and manufacturing drawings
  - . Specifications and calls for bid for the contractors
- Perform equipment searches and obtain specifications, prices, etc.

TABLE 11: (continued) Definitions of tasks of the Commercial-, Technical-, and Control, Testing and Development Departments

CONTROL, TESTING AND DEVELOPMENT DEPARTMENT

Control and Testing Unit

- Establish working-, manufacturing- and control methods, operations and procedures for manufacturing to be done for KEDEC under contract
- Supervise manufacturing start-up of contractors
- Supervise all tests
- Refine working-, manufacturing-, and control methods, operations and procedures for manufacturing under contract
- Perform final inspection. The object of the final inspection is to ensure, with a minimum number of interventions, that the ordered product conforms to the customer's specifications and requirements.

The final inspection includes:

- . Witnessing of performance tests, that is:
  - verification of the calibrating of the measuring instruments
  - attendance to the various individual tests
  - attendance to the type- and prototype tests
- . Visual inspection before shipping, that is:
  - control of the conformity of the equipment and individual parts with the outline drawings, the number and location of accessories, etc.
  - control of the general conditions of the surfaces and of surface finish, of the proper assembly of all parts, of the degree of cleanliness, and of the quality of paintwork
  - verification of quantities and/or weights.

TABLE 11:(continued) Definition of tasks of the Commercial-, Technical-, and Control, Testing and Development Departments

- Continuously perform quality assurance. The object of KEDEC's quality assurance function is to assess, in connection with a specific product, the overall performance of a manufacturer, with particular attention given to the assurance of constant respect of the requirements of a prescribed specification in the established manufacturing- and control operations and procedures.

KEDEC's quality assurance programme includes:

- . Control of the correct choice, interpretation, and application of specifications, standards, and processes
  - . Supervision of production- and quality control procedures
  - . Control of production equipment and of the professional qualification of personnel
  - . Critical assessment of the technical performance attained at each stage during the course of the execution of a given order
- Perform acceptance tests.

TABLE 12: KEDEC staff number and qualifications; end of first stage of KEDEC

| <u>ORGANISATION UNIT</u> <sup>1)</sup> | <u>STAFF NUMBER AND QUALIFICATIONS</u>  |
|--|---|
| Director                               | 1 graduate engineer in electronics, with strong experience in management of industrial enterprise                                       |
| Administrative Department              | 1 administrative assistant with private industry experience<br>1 chartered accountant   |
| Commercial Department <sup>2)</sup>    | 4 graduate engineers (electronic/electrical) at least 2 with strong practical experience and at least 1 with sound marketing experience |
| Technical Department                   | 2 graduate engineers (electronic/electrical) 1 with practical experience<br>4 engineering technicians                                   |
| Control and Testing Department         | 4 graduate engineers (electronic/electrical), at least 1 with strong practical experience<br>3 engineering technicians<br>3 technicians |
|  | <hr/> 23 persons (by end of first stage of KEDEC) <sup>3)</sup>   |

1: See Figure 3 for organisational structure of KEDEC

2: The commercial department is redundant for the case where private industry accepts the commercial responsibility.

3: The number of persons actually employed will depend greatly on the role finally determined for KEDEC and on the extent of testing and control operations. Figure shown should be taken as a probable maximum.

## 8.5 INITIATE SECOND STAGE OF KEDEC

The second stage of the implementation of KEDEC has two objectives:

- the addition of a product development function
- the beginning of the assuming of the responsibility for quality assurance for the entire electronics industry in Kenya.

The product development unit would be attached to the Control and Testing Unit to form the combined Control, Testing and Development Department of KEDEC. The development function is designed to provide assistance in product commercialisation to the private Kenyan parties and business firms having ideas for, or tentative designs for, new electronic products or products especially adapted to Kenyan conditions. Specifically, this assistance can take the form of:

- obtaining prototype quantities of components (most components suppliers do not want to bother with such small orders)
- technical advice in circuitry
- construction of prototype runs of circuit boards
- testing
- market study and marketing coaching.

Depending on the exact charter established for KEDEC, the development function could be extended to the development of KEDEC-initiated product designs.

The addition of the development function would require additional personnel, as shown in Table 13. A flowsheet of the activities required for the development of an electronic device at KEDEC, along with the responsibilities of KEDEC, industry, and the end users of the device, are shown in Table 14.

TABLE 13: Additional staff needed to implement KEDEC second stage; total staff for second stage

| <u>ORGANISATIONAL UNIT</u>                                | <u>STAFF NUMBER AND QUALIFICATIONS</u>  |
|---|---|
| Control, Testing and Development Department <sup>1)</sup> |   |
| - Development   | 2 graduate engineers (electronic/electrical) with strong practical experience |
|   | 1 engineering technician  |
|   | 1 technician  |
|   | —   |
| Total Development Unit                                    | 4 additional personnel  |
|   | 23 existing personnel, KEDEC first stage                                      |
|   | —   |
| Total KEDEC second stage                                  | 27 persons <sup>2)</sup>  |

1: The name of this department changes at KEDEC second stage to reflect addition of new unit, Development.

2: The number of persons actually employed will depend greatly on the role finally determined for KEDEC and on the extent of testing and control operations. Figure shown should be taken as a probable maximum.

**TABLE 14:** Flowsheet of activities required for the development of an electronic device; responsibilities of KEDEC, contractors, and end-users of device

| TASK  | SHARE OF RESPONSIBILITY |                                |           |
|---|-------------------------|--------------------------------|-----------|
|   | KEDEC <sup>1)</sup>     | CONTRACTORS<br>(Manufacturers) | END-USERS |
| Research activities and basic studies                         | ●                       | ●                              | ●         |
| Basic information inputs<br>- user-and operating requirements | ●                       |                                | ●         |
| - technical requirements                                      | ●                       |                                | ●         |
| Provisional specifications                                    | ●                       | ●                              | ●         |
| Development   | ●                       | ●                              |           |
| Prototype tests   | ●                       |                                |           |
| Final specifications  | ●                       | ●                              | ●         |
| Booking orders <sup>2)</sup>                                  |                         | ●                              |           |
| Acceptance tests  | ●                       | ●                              | ●         |
| Running-in/ special investigations                            | ●                       |                                | ●         |

Timing of activities

1) Kenyan Electronic Development Centre

2) Not a research and development activity; included to maintain orderly flow of tasks

**Legend:** ● major responsibility  
● minor responsibility



## 8.6 PREPARE AND IMPLEMENT THIRD STAGE OF KEDEC

The goals for the third stage of KEDEC are:

- to strengthen the technical skills of the Control and Testing Unit to prepare it for dealing with the sophisticated telecommunications equipment scheduled for installation in Kenya by the Post and Telecommunications
- to consolidate its quality assurance function for the entire electronics industry in Kenya
- to transfer to the private sector as an electronics engineering consulting firm the Commercial-, Technical-, and Development units of KEDEC. (Or if the commercial function has been performed up until that time by the private sector, the transfer would be only of the remaining two units, Technical and Development).

The strengthening of the technical skills of the Control and Testing Unit is considered a vital part of the development of the electronics industry in Kenya because the dependence on expensive foreign skills would be largely replaced by Kenyan skills.

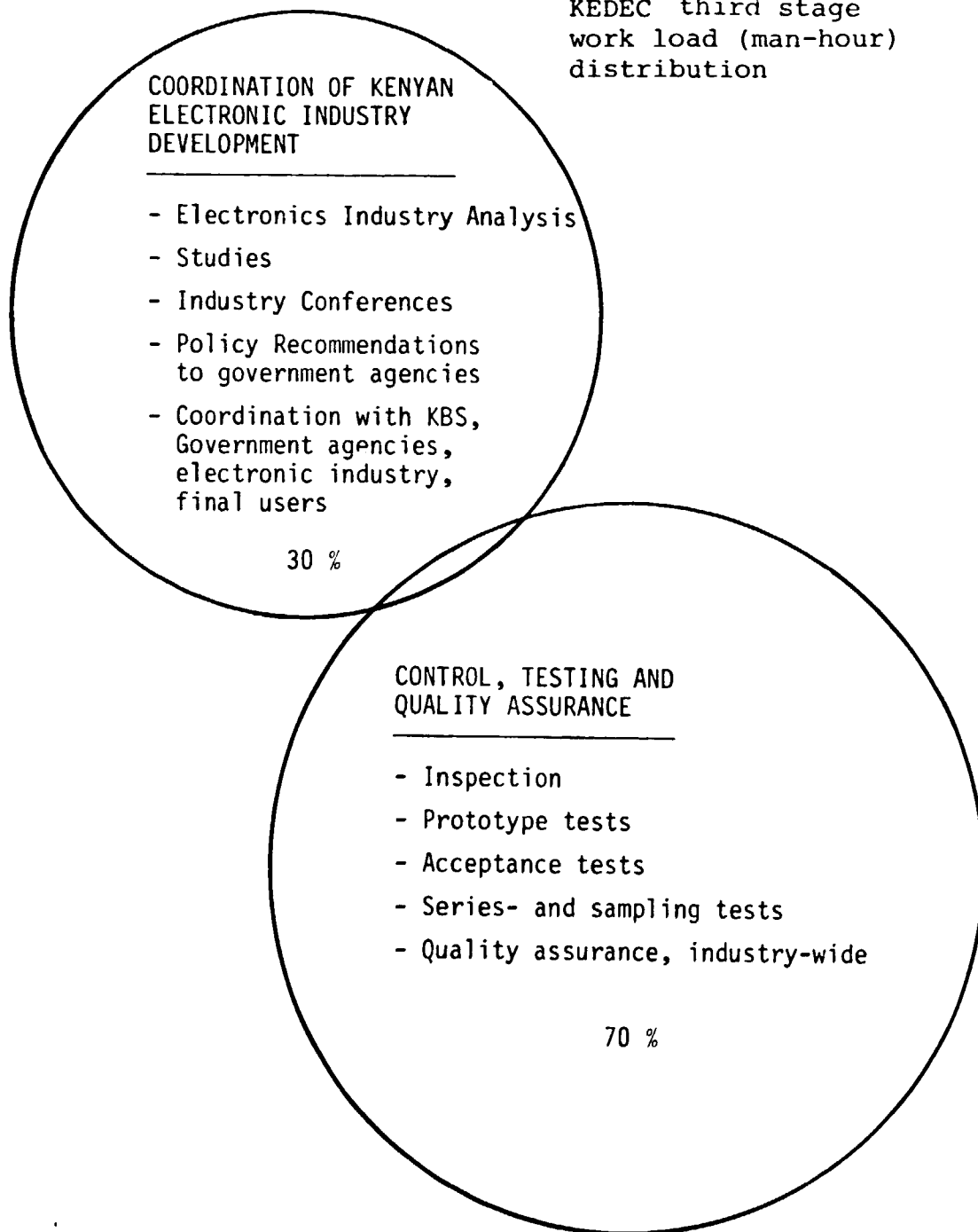
This strengthening of technical skills would require a rather costly transfer of technology from a developed country's telecommunications testing, research and development centre. Tentatively, this transfer is proposed to be effected by negotiating through diplomatic channels a consultancy contract with such a centre, an example of which is presented as Appendix D.

The proposed functions of KEDEC in its third stage and the work-load distribution are shown in Figure 4, while the organisation structure proposed for executing these functions is presented in Figure 5.

KEDEC would then retain permanently its form and functions attained at the third stage.

FIGURE 4:

KEDEC third stage  
work load (man-hour)  
distribution



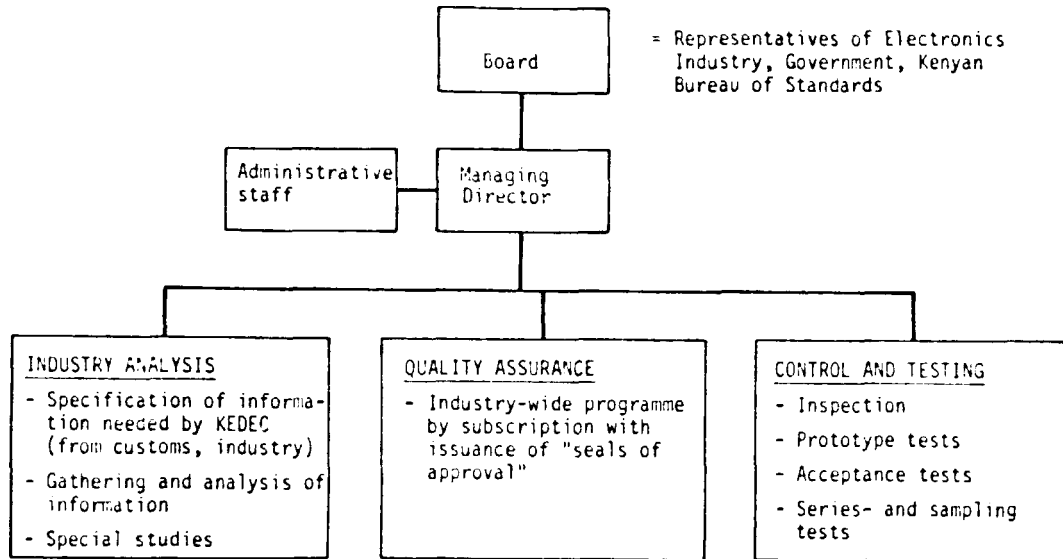


FIGURE 5: Organisation chart, KEDEC stage three

Note: For this form of organisation, it is assumed that the Commercial-, Technical- and Development units have been transferred to the private sector as an electronic engineering consulting firm.

9. TRAINING REQUIREMENTS AND SOURCES OF TECHNICAL KNOW-HOW APPROPRIATE FOR CARRYING OUT THE PROPOSED ACTIONS

The types of training and appropriate sources of technical know-how required at the various stages in implementing the proposed actions are given below:

- Acquisition of equipment for the proposed components manufacture: The choice of equipment should be made after deciding exactly on which standards to use for the selected components. Equipment suppliers should be from from the first four countries of Table 4 to ensure that the components manufactured can be most readily incorporated into the electronic products already assembled in Kenya and to maximise the possibilities of attracting new electronics investments in Kenya.
- Operation of equipment in the proposed components manufacture: The training required consists mainly of forming proper work attitudes as very little technical training is required. Most of the training could be done by existing Kenyan institutions such as technical schools and the Kenyan Institute of Management. Some training by equipment suppliers may be necessary, but is likely to represent only a very small part of equipment costs.
- Initial training of the Control and Testing Unit of KEDEC: Some of the qualified personnel required can be found readily in Kenya and the qualifications of other personnel can be upgraded by training furnished under contract to KEDEC by certain of the electronic companies already established in Kenya and perhaps by the Polytechnic and the Kenyan Institute of Management. Some training in control and testing skills from sources outside of Kenya may be needed.
- Strengthening of skills of the Control and Testing Unit: As mentioned in 8.6, this skill strengthening is aimed at replacing expensive foreign skills by Kenyan skills especially in the area of control and testing of telecommunications equipment. The required training would be best supplied through contractual arrangement with an established telecommunications testing, research and development centre of a second country.

- Training by "induction": This refers to the transfer of skills to Kenyan personnel working closely with the experts working on the implementation of proposed actions:
- . Setting of appropriate tariffs and duties
  - . Performing of the detailed feasibility studies
  - . Elaboration of appropriate equipment ownership and financing schemes (equipment for components manufacture)
  - . Establishment of KEDEC's charter, job descriptions, procedures, management information system, recruiting
  - . Elaboration of KEDEC building ownership and financing scheme
  - . Elaboration of underwriting scheme for budget of "development" unit of KEDEC
  - . Elaboration of scheme for evaluating and selecting transfer of technology, training for the strengthening of skills of the Control and Testing Unit.

Experts can be lent to IPD and KEDEC from international organisations such as UNIDO and GATT (for tariff expertise).

# ICME

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## A P P E N D I X   A

Letter sent by ICME to Presidents of  
several European and American Electronics  
Companies before Departure of Project  
Team for Kenya

# Business Consultants

ICME AG, Bellariastrasse 51, CH-8038 Zurich, Telephone 01/45 96 95, Telex 55158 icme ch

Consulting areas:

Management consulting  
Marketing and technology  
Organization and EDP  
Industrial redeployment

XX May 1981 DR/G

Mr. XY  
President

XYZ Electronics

Dear Mr. XY

Our company has been charged by the United Nations Industrial Development Organisation (UNIDO) and the Ministry of Industries of the Government of Kenya to determine:

- the feasibility of establishing an electronics industry in Kenya
- which branches of the electronics industry could best be developed
- a method and plan for establishing the chosen electronics industry branches.

The ICME project team will return from Kenya on 15th June 1981 with the solutions to the first two problems above. In order to help resolve the third item, method and plan, we request a meeting with you to present our findings and to discuss:

- your reactions to our findings
- your disposition toward participation in an international "team" (to distribute risks) of electronics manufacturers which would establish itself in Kenya
- the conditions under which you would consider such a participation

- other arrangements for establishing electronics manufacturing in Kenya
- the steps to take to formally conceive and initiate such a project

So that we can make arrangements while our team is still in Kenya, please inform us of the possibility of meeting with you late in June or early in July.

We emphasize that our evaluation of establishing an electronics industry in Kenya will be objective, professional and rigorous and that should we conclude positively, any resulting project will have the highest level support of the Kenyan government and will be eligible for financing from various international agencies.

We look forward to discussing our findings with you. Please contact me at your earliest convenience.

Very truly yours,

B. Simma  
President  
ICME Business Consultants



## A P P E N D I X B

- Part 1: Electronics products manufacturers/sales and service organisations/research centres located outside of Kenya and interviewed during course of study
- Part 2: Electronic product manufacturers located outside of Kenya, contacted, but not interviewed in-depth
- Part 3: Other Kenyan organisations, contacted during course of study, but not interviewed in-depth

APPENDIX B      Electronic products manufacturers/sales and service  
 Part 1              organisations/research centres located outside of  
                          Kenya and interviewed during course of study

| <u>BRANCH OF ELECTRONICS INDUSTRY</u><br><u>PERSONS CONTACTED/ORGANISATIONS</u> | <u>ACTIVITY</u> |
|---|-----------------|
|---|-----------------|

ELECTRONIC COMPONENTS

Phillips Gloeilampenfabrieken N.V.  
 Eindhoven, Netherlands

- Manufacture of electronic components
- Research and development of appropriate manufacturing technology, operation, and training for manufacture of electronic and non-electronic components in developing countries
- Set up of electronic- and non-electronic components manufacturing facilities in developing countries under various ownership and transfer-of-technology arrangements

DOMESTIC ELECTRONICS

Phillips Gloeilampenfabrieken N.V.  
 Eindhoven, Netherlands

- Manufacture of portable radios, radio-cassettes, radio-cassette stereos, television sets
- Manufacture of phonograph records and cassettes

APPENDIX B (continued) Electronic products manufacturers/sales and service organisations/research centres located outside of Kenya and interviewed during course of study

Part 1

BRANCH OF ELECTRONICS INDUSTRY  
PERSONS CONTACTED/ORGANISATIONS

ACTIVITY

COMMUNICATIONS ELECTRONICS

Mr. Oliver Novick  
General Telephone & Electronics (GTE)  
Milano, Italy

- Manufacture, sales and service of telephone exchanges and PBX, PABX systems

Hasler AG  
Berne, Switzerland

- Manufacture, sales and service of electronic telecommunications devices

Brown, Boveri & Cie. AG  
Baden, Switzerland

- Manufacture, sales and service of electronic telecommunications devices

Swiss PTT Testing and Research Centre, Berne, Switzerland

- Responsible for the testing and approval of all telecommunication equipment used in the country; undertakes special investigation projects and limited research not elsewhere performed. Three divisions:

- Materials testing

- Line communications testing and technology

- Wireless communications testing and technology

(See Appendix B for details)

INSTRUMENTATION ELECTRONICS

Hasler AG  
Berne, Switzerland

- Manufacture, sales and service of telecommunications instrumentation devices

APPENDIX B (continued) Electronic products manufacturers/sales and service organisations/research centres located outside of Kenya and interviewed during course of study  
Part 1

| <u>BRANCH OF ELECTRONICS INDUSTRY</u><br><u>PERSONS CONTACTED/ORGANISATIONS</u> | <u>ACTIVITY</u> |
|---|-----------------|
|---|-----------------|

INSTRUMENTATION ELECTRONICS (cont.)

Brown, Boveri & Cie. AG  
Baden, Switzerland

Manufacture, sales and service of:

- Telecommunications instrumentation devices
- Industrial- and instrumentation electronic devices

APPENDIX B      Electronic product manufacturers located outside  
Part 2            of Kenya, contacted, but not interviewed in-depth

| <u>BRANCH OF ELECTRONICS INDUSTRY<br/>PERSONS CONTACTED/ORGANISATIONS<sup>1)</sup></u> | <u>ACTIVITY</u> |
|--|-----------------|
|--|-----------------|

ELECTRONIC COMPONENTS

|   |   |
|---|---|
| Texas Instruments (Switzerland) S.A. <sup>2)</sup><br>Geneva, Switzerland | - Manufacture of electronic components, especially semi-conductor devices, integrated circuits and micro-processors |
|---|---|

DOMESTIC ELECTRONICS

|  |   |
|--|---|
| Hewlett-Packard S.A. <sup>2)</sup><br>Geneva, Switzerland<br>(Europe, Africa, Middle East) | - Manufacture/sales of calculators and small business computers |
|--|---|

|   |   |
|---|---|
| Texas Instruments (Switzerland) S.A. <sup>2)</sup><br>Geneva, Switzerland | - Manufacture/sales of calculators and small business computers |
|---|---|

|  |  |
|--|--|
| Heathkit Corporation<br>Benton Harbour, Michigan (USA) | - Manufacture of ready-to-assemble kits:<br>- calculators<br>- portable radios<br>- hi-fi stereos<br>- television sets |
|--|--|

|   |  |
|---|--|
| Tandy Corporation<br>Ft. Worth, Texas (USA) | - Manufacture of:<br>- calculators<br>- radio, radio-cassettes, radio-cassette stereos<br>- television sets<br>- personal and small business computers |
|---|--|

APPENDIX B (continued) Electronic product manufacturers located  
part 2 outside Kenya, contacted, but not inter-  
viewed in-depth

BRANCH OF ELECTRONICS INDUSTRY  
PERSONS CONTACTED/ORGANISATIONS<sup>1)</sup> ACTIVITY

COMMUNICATIONS ELECTRONICS

GTE  
Belgium

- Manufacture of telephone handsets
- Set up of telephone handset manufacturing on turn-key or other technology transfer basis in developing countries

Tandy Corporation  
Ft. Worth, Texas (USA)

- Manufacture, sales of personal radio-communications equipment (citizen's band)

INSTRUMENTATION ELECTRONICS

Beckman Instruments S.A.<sup>2)</sup>  
Geneva, Switzerland

- Manufacture, sales of electronic instruments

Hewlett-Packard S.A.<sup>2)</sup>  
Geneva, Switzerland  
(Europe, Africa, Middle East)

- Manufacture, sales of electronic instruments

Heathkit Corporation  
Benton Harbour, Michigan (USA)

- Manufacture of ready-to-assemble kits (CKD)<sup>3)</sup> for electronic instruments

1) Organisations not interviewed because of lack of time or funds unless otherwise indicated

2) Subsidiary of U.S. parent company

3) CKD: Completely Knocked-Down

APPENDIX B      Other Kenyan organizations, contacted during  
 Part 3            the course of the study, but not interviewed  
                      in-depth

| <u>ORGANISATIONS</u>   | <u>ACTIVITY</u>                             |
|--|---|
| Kenya Bureau of Standards  | Adopting and implementing of standards      |
| University of Nairobi<br>- Department of Electrical Engineering<br>- Department of Physics | Instruction; research                       |
| Directorate of Civil Aviation  | Regulation and control of civil aviation    |
| National Chamber of Commerce   | National forum for the industrial community |

Note: All organisations located in Nairobi, Kenya.  
 Organisations not interviewed because of lack of time or funds.

A P P E N D I X C

Average annual imports (1979 - 1980)  
of electronic products to Kenya



APPENDIX C                      Average annual imports (1979 - 1980)  
of electronics products to Kenya<sup>1)</sup>

| ITEM   | <u>UNITS OR<br/>KG IMPORTED</u> | <u>VALUE IN<br/>(US\$)</u> |
|--|---------------------------------|----------------------------|
| TRANSFORMERS AND PARTS OTHER THAN LIQUID DI-ELECTRIC TRANSFORMERS  | 67,055                          | 3,505,388                  |
| BATTERIES AND CELLS FOR FLASHLIGHTS (TORCHES) AND TRANSISTOR RADIOS  | 6,725,181                       | 874,253                    |
| ELECTRICAL LINE TELEPHONIC AND TELEGRAPHIC APPARATUS (including such apparatus for carrier current line systems) |                                 |                            |
| 1. Apparatus   | 346,093                         | 11,885,547                 |
| 2. Parts   | 125,384kg                       | 5,011,541                  |
| MICROPHONE AND STANDS THEREFOR, LOUDSPEAKERS, AUDIO- FREQUENCY AMPLIFIERS  |                                 |                            |
| 1. Apparatus including stands for microphones  | 25,958                          | 4,412,620                  |
| 2. Parts   | 15,675kg                        | 265,144                    |
| TELEVISION   |                                 |                            |
| 1. Assembled TV colour receivers including receivers incorporating sound recorders or reproducers                | 4,253                           | 1,775,163                  |
| 2. Same, unassembled   | 935                             | 425,499                    |
| 3. Same, assembled, but for observation and control of industrial operations                                     | 254                             | 180,691                    |
| 4. Assembled monochrome TV receivers including receivers incorporating sound recorders or reproducers            |                                 |                            |

1) Based on Kenyan customs data for 1979 and 1980

|   | UNITS OR<br>KG IMPORTED | VALUE IN<br>(US\$) |
|---|-------------------------|--------------------|
| 5. Same, unassembled  | 1,187                   | 266,915            |
| 6. Same, assembled, but for the observation and control of industrial operations  | 97                      | 9,428              |
| <b>RADIO</b>  |                         |                    |
| 1. Radio-broadcast receivers, designed or adapted for fitting to motor vehicles, including receivers incorporating sound recorders or reproducers | 1,589                   | 81,268             |
| 2. Assembled portable radio-broadcast receivers, including receivers incorporating sound recorders or reproducers                                 | 6,359                   | 549,448            |
| 3. Same, unassembled  | 13,208                  | 292,453            |
| 4. Assembled other radio-broadcast receivers, including receivers incorporating sound recorders or reproducers                                    | 4,697                   | 390,503            |
| 5. Same, unassembled  | 5,742                   | 215,825            |
| <b>TV / RADIO PARTS</b>   |                         |                    |
| 1. Parts suitable for use as parts of radio or TV receiving sets or radio/gramophones   | 114,739kg               | 4,014,113          |
| 2. Parts, other   | 52,339kg                | 3,618,895          |
| 3. TV cameras   | 56                      | 23,208             |
| <b>ELECTRIC SOUND OR VISUAL SIGNALLING APPARATUS<br/>(such as bells, sirens, indicator panels, burglar and fire alarms)</b>                       |                         |                    |
| 1. Fire alarm / detection system  | 5,610                   | 320,904            |
| 2. Other  | 24,886                  | 373,831            |

|   | UNITS OR<br>KG IMPORTED | VALUE IN<br>(US\$) |
|---|-------------------------|--------------------|
| ELECTRICAL APPARATUS FOR MAKING AND BREAKING ELECTRICAL CIRCUITS, FOR THE PROTECTION OF ELECTRICAL CIRCUITS OR FOR MAKING CONNECTIONS TO ORIGIN ELECTRICAL CIRCUITS (such as switches, relays, fuses, lightning arresters, surge suppressors, plugs, lampholders and junction boxes)  | 73,620                  | 362,458            |
| RESISTORS FIXED OR VARIABLE OTHER THAN HEATING RESISTORS (including potentiometers)   | 2,240kg                 | 60,830             |
| PRINTED CIRCUITS, SWITCH BOARDS (other than telephone switchboards) AND CONTROL PANELS, ALL SUITABLE FOR USE IN RADIO OR TV RECEIVING SETS OR RADIO/GRAMOPHONES   | 6,928                   | 158,432            |
| THERMOIONIC, COLD CATHODE AND PHOTOCATHODE VALVES AND TUBES (including vapour or gas-filled valves and tubes, cathode-ray tubes, television camera tubes and mercury-arc rectifying valves and tubes; PHOTOCELLS; MOUNTED PIEZO-ELECTRIC CRYSTAL; DIODES, TRANSISTORS AND SIMILAR SEMI-CONDUCTOR DEVICES; ELECTRONIC MICRO-CIRCUITS |                         |                    |
| 1. Cathode-ray TV picture tubes   | 203kg                   | 7,961              |
| 2. Other electronic valves and tubes (including TV camera tubes) for industrial use   | 932kg                   | 100,860            |
| 3. Other electronic valves and tubes (including TV camera tubes) for radio or TV receiving sets or radio/gramophones  | 1,211kg                 | 86,489             |
| 4. Other electronic valves and tubes  | 1,148                   | 176,111            |
| 5. Diodes, transistors and similar semiconductor devices; photocells (including photodiodes and phototransistors)   |                         |                    |
| 5.1 For industrial use  | 3,863kg                 | 129,022            |
| 5.2 For radio or TV receiving sets or radio/gramophones   | 80kg                    | 3,716              |
| 5.3 Other   | 20,031                  | 146,444            |

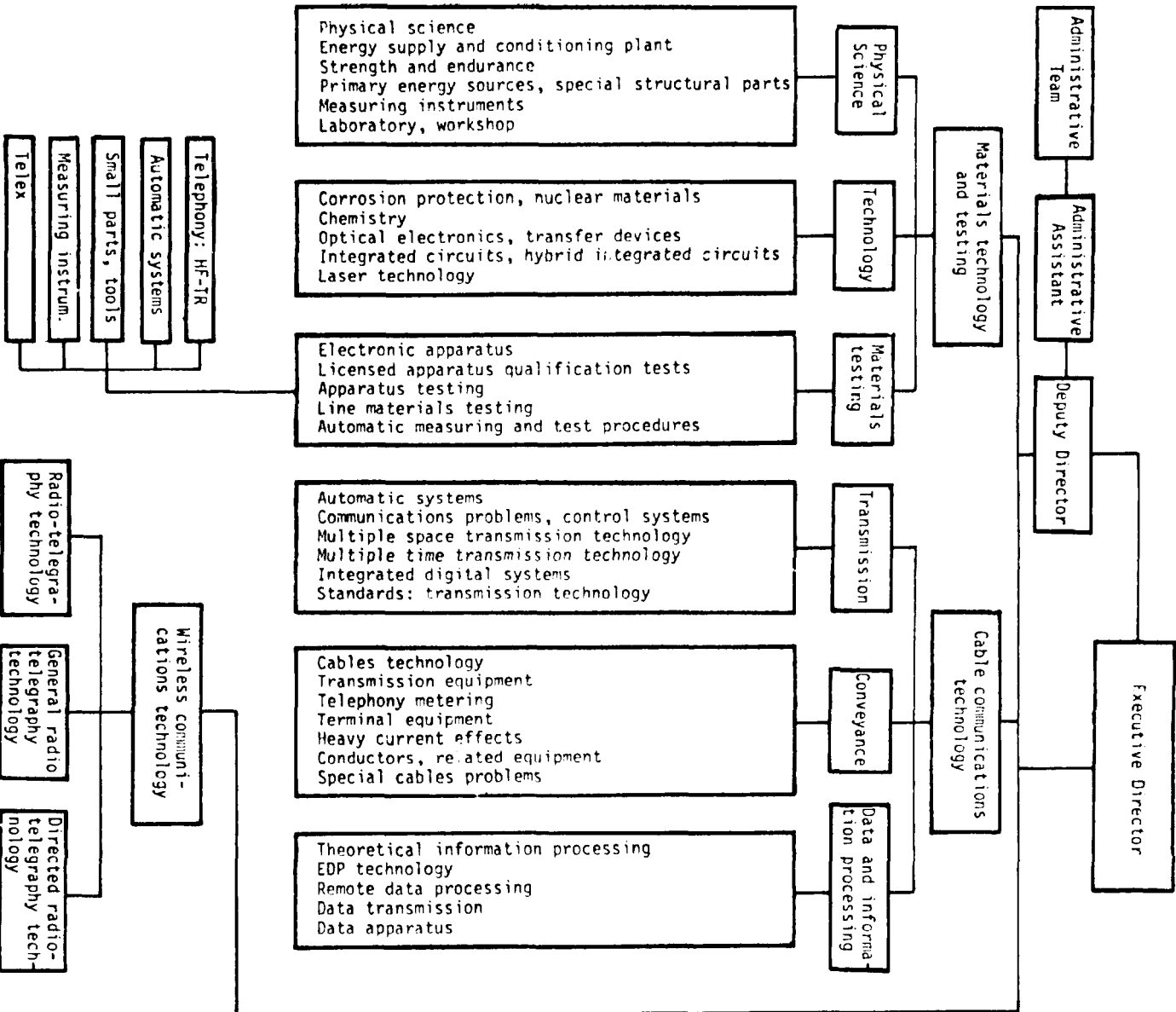
|  | <u>UNITS OR<br/>KG IMPORTED</u> | <u>VALUE IN<br/>(US\$)</u> |
|--|---------------------------------|----------------------------|
| <b>ELECTRONIC MICRO-CIRCUITS</b>   |                                 |                            |
| 1. For industrial use  | 80kg                            | 7,836                      |
| 2. For radio or TV receiving sets or radio/<br>gramophones   | 13kg                            | 1,681                      |
| 3. Other   | 93kg                            | 3,281                      |
| <b>PIEZO-ELECTRIC CRYSTAL, MOUNTED PARTS SUITABLE<br/>FOR USE AS PARTS OF RADIO OR TV RECEIVING SETS<br/>OR RADIO/GRAMOPHONES</b>  |                                 |                            |
|  | 2,504kg                         | 9,926                      |
| PARTS, other   | 2,326kg                         | 62,917                     |
| <b>MEDICAL, DENTAL, SURGICAL AND VETERINARY<br/>APPLIANCES</b>   |                                 |                            |
| 1. Electro-medical apparatus (other than<br>radiological apparatus)  | 133,649                         | 2,757,077                  |
| 2. Hearing aids  | 4,379                           | 44,725                     |
| 3. Apparatus based on the use of x-rays or<br>of the radiations of radio-active sub-<br>stances (including radiography and radio-<br>therapy apparatus)  | 1,356                           | 2,491,946                  |
| <b>INSTRUMENTS AND APPARATUS FOR MEASURING,<br/>CHECKING OR AUTOMATICALLY CONTROLLING THE FLOW,<br/>DEPTH, PRESSURE OR OTHER VARIABLES OF LIQUIDS/<br/>GASES OR FOR AUTOMATICALLY CONTROLLING TEMPE-<br/>RATURES</b> |                                 |                            |
| 1. For use in motor vehicles   | 27,347                          | 273,824                    |
| 2. For use in domestic appliances  | 6,038                           | 49,783                     |
| 3. Other   | 119,045                         | 2,155,593                  |

|   | UNITS OR<br>KG IMPORTED | VALUE IN<br>(US\$) |
|---|-------------------------|--------------------|
| INSTRUMENTS AND APPARATUS FOR PHYSICAL AND CHEMICAL ANALYSIS (such as polarimeters, refractometers, gas analysis apparatus); FOR MEASURING AND CHECKING VISCOSITY, POROSITY, EXPANSION, SURFACE TENSION OR THE LIKE (such as viscosimeters, porosimeters, expansion meters); FOR MEASURING AND CHECKING QUANTITIES OF HEAT, LIGHT OR SOUND (such as photometers, exposure meters, calorimeters) |                         |                    |
| 1. Exposure meters  | 165                     | 48,199             |
| 2. Other  | 9,636                   | 1,018,231          |
| GAS, LIQUID AND ELECTRICITY SUPPLY OR PRODUCTION METERS; CALIBRATING METERS THEREFOR  |                         |                    |
| 1. Gas and liquid meters  | 220                     | 9,112              |
| 2. Other  | 6,279                   | 360,692            |
| ELECTRICAL MEASURING, CHECKING, ANALYSING OR AUTOMATICALLY CONTROLLING INSTRUMENTS AND APPARATUS  |                         |                    |
| 1. Electronic automatic regulators (controllers) suitable for use in motor vehicles   | 25,299                  | 215,076            |
| 2. Electrical revolution counters, production counters and the like, as integrated parts of industrial machinery  | 6,039                   | 163,995            |
| 3. Electrical revolution counters, production counters and the like, other  | 1,908                   | 79,598             |
| 4. Electronic automatic regulators (controllers), other   | 4,236                   | 280,750            |
| 5. Electronic instruments and apparatus for measuring or detecting ionising radiations  | 4,142                   | 308,932            |
| 6. Other electronic instruments and apparatus   | 32,014                  | 1,513,662          |

|  | <u>UNITS OR<br/>KG IMPORTED</u> | <u>VALUE IN<br/>(US\$)</u> |
|--|---------------------------------|----------------------------|
| GRAMOPHONES, DICTATING MACHINES AND OTHER SOUND RECORDERS AND REPRODUCERS, INCLUDING RECORD PLAYERS AND TAPE DECKS, WITH OR WITHOUT SOUND HEADS; TV IMAGE AND SOUND RECORDERS AND REPRODUCERS, MAGNETIC  |                                 |                            |
| 1. Coin-operated gramophones   | 182                             | 50,289                     |
| 2. Other electric gramophones and record players, assembled  | 2,708                           | 358,056                    |
| 3. Same, unassembled   | 8,939                           | 361,893                    |
| 4. TV image and sound recorders and reproducers, magnetic, assembled   | 6,632                           | 1,558,802                  |
| 5. Same, unassembled   | 1,992                           | 125,373                    |
| 6. Dictating machines and accessories  | 615                             | 603,055                    |
| GRAMOPHONE RECORDS AND OTHER SOUND OR SIMILAR RECORDINGS; MATRICES FOR THE PRODUCTION OF RECORDS, PREPARED RECORD BLANKS, FILM FOR MECHANICAL SOUND RECORDING, PREPARED TAPES, WIRES, STRIPS AND LIKE ARTICLES OF A KIND COMMONLY USED FOR SOUND OR SIMILAR RECORDINGS |                                 |                            |
| 1. Prepared media for sound or similar recording   | 6,924                           | 58,505                     |
| 2. Gramophone records of 7" diameter or less   | 1,548                           | 16,918                     |
| 3. Gramophone records, other   | 23,593                          | 93,507                     |

## A P P E N D I X D

Functions, Organisation, and facilities  
of a national telecommunications testing,  
research and development centre: Example  
of the Swiss PTT



**FIGURE 6: Organisation chart of Swiss PTT Telecommunications Testing, Research and Development Centre**



TABLE 15: Staff, volume of activities and cost structure of the Swiss PTT Telecommunications Testing, Research and Development Centre

|                                  |   |             |            |
|----------------------------------|---|-------------|------------|
| <u>STAFF:</u>                    | 275 persons total, of whom:   |             |            |
|                                  | - Graduated engineers, physicists   |             |            |
|                                  | - Chemists  | 47 %        |            |
|                                  | - Engineering technicians   |             |            |
|                                  | - Qualified technicians   |             |            |
|                                  | - Unskilled workers   | 48 %        |            |
|                                  | - Laboratory assistants   |             |            |
|                                  | - Administrative staff  | 5 %         |            |
| <u>ANNUAL ACTIVITIES VOLUME:</u> | - Orders commissioned by others   | 650         |            |
|                                  | - Reports   | 1,000       |            |
|                                  | - Research projects   | 45          |            |
|                                  | - Value of equipment tested approx. US\$                                    | 250 million |            |
| <u>COST STRUCTURE:</u>           | - Capital costs (research, testing, US\$ measuring apparatus)               | 2 million   |            |
|                                  | - Research and development orders commissioned to industry and universities | 3 million   |            |
|                                  | - Staff costs   | 8.5         |            |
|                                  | - General costs   | 1.5 million |            |
|                                  | Total   | US\$        | 15 million |

TABLE 16:

Technical characteristics of the Swiss  
PTT Telecommunications, Testing, Research  
and Development Centre building

|                             |   |
|-----------------------------|---|
| Dimensions                  | Base: 40,27 m x 15,26 m<br>Height above street level: 86 m<br>Effective surface by floor: 230 m <sup>2</sup> , not including<br>laboratory closets; office area: 94 m <sup>2</sup>              |
| Floors                      | 3 underground floors<br>Ground floor<br>Mezzanine with 4 conference rooms<br>17 floors<br>3 roof levels   |
| Elevators                   | 3 elevators (capacity: 8); speed: 1.75 m/sec<br>(trip duration: approx. 50 seconds)<br><br>One elevator for goods (capacity: 1.5 tons);<br>speed: 1,2 m/sec (trip duration: approx. 75 seconds) |
| Auditorium                  | 210 seats; projection booth for films and slides  |
| Air-conditioning<br>plant   | With the exception of the office areas, a total of<br>seven floors are entirely air-conditioned   |
| Flexion of the<br>building: | At wind speeds of 120 km/h, deviation at the top<br>of building is 4 cm (calculated value)  |
| Weight                      | Building: 20,000 tons<br>Load by column in lobby: 1270 tons   |
| Cost                        | approx. US\$ 10 mio; cost per m <sup>3</sup> : less than US\$ 150   |
| Sun Protection:             | In case of intensive solar radiation and if staff<br>is not present, the Venetian blinds of the East<br>and West frontages are automatically controlled.  |

